THE

ELECTRICAL REVIEW.

VOL. XXXV. SEPTEMBER 28, 1894. No. 879

CONTENTS:

	PAGE
The Working of Central Stations	365
Flocculent Electro-depositions	367
Swinburne's Potentiometers for Alternating Currents (*illustrated*)	367
Mechanical Draught.—II.	368
The Industrial Efficiency of Electrical Accumulators	369
Conductivity Balance (*illustrated*)	370
Notes on the Design of Large Alternators	371
Notes on the Steam Turbine (*illustrated*)	372
An Electric System of Shot-firing in Mines (*illustrated*) ...	373
A Second Keely	373
The Waddell-Entz Dynamo and Motor (*illustrated*)	374
Government Inspection of Electric Light and Meters in Canada	376
Correspondence:—The action of Alternating Currents on Dielectrics, and a Note on Electric Shocks	376
Professional Etiquette	377
The Money-Nash Arc Lamp	377
Portable Batteries: Patent Law Protection	377
The Design of Small Dynamos	377
The Velvo Primary Battery	377
Chelsea Electric Lighting	377
Business Notices, &c.	378
Contracts Open and Closed	380
Books Received	380
Notes	381
City Notes, &c.	385
Traffic Receipts	386
Share List of Electrical Companies	387
Gaseous Fuel	388
The Lyons-Oullins Electrical Tramway (*illustrated*) (*continued*)	389
Reviews:—A Treatise on the Measurement of Electrical Resistance	390
Turning Lathes.—Chats on Invention	391
Electrician-in-Charge	391
New Patents	391
Abstracts of Published Specifications	392

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

PRICE 4/- POST FREE.
The Leading Electrical Trades Directory and the Oldest Electrical Directory in the World.

1895 ISSUE
NOW IN
PREPARATION.

PRICE 4/- POST FREE.
Fully Revised and Thoroughly Reliable.
Contains a larger amount of Trade Matter than any other Electrical Directory.

H. ALABASTER, GATEHOUSE & CO.,
22, Paternoster Row, London, E.C.

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—22, PATERNOSTER ROW, LONDON.

Telegraphic Address: "AGREKAY, LONDON." Code A B C. Telephone No. 517.
ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades.

SUBSCRIPTION RATES.—In *Great Britain*, Post Free, per Year, 19s. 6d. To all *Foreign Countries* (except those mentioned below), per Year, £1 1s. 8d. *Exceptions.*—Abyssinia, Aden, Borneo, Ceylon, India, Java, Labuan, Mozambique, Penang, Persia (*viâ* Brindisi), Phillipine Islands, Singapore, Zanzibar, to which the rates are: per Year, £1 8s, 10d.
BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.
CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each.
FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. *Paris:* VEUVE J. BOYVEAU, 22, Rue de la Banque. *Berlin:* ASHER & Co., 5, Unter den Linden.
Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 22, Paternoster Row, E.C.

THE WORKING OF CENTRAL STATIONS.

Now that we are approaching the season when central station engineers are girding up their loins to get the most efficient results out of their machinery, a few remarks on the smaller economies might not be amiss. Of late we have been overwhelmed with the results of tests of boilers, engines and electrical machinery, showing their degrees of perfection, and preference is too often given to the particular machine or combination of machines which shows the highest efficiency during these full load tests. When one reflects, it is a little curious that such tests of the laboratory order should have cast a glamour over many electrical engineers, for the merest tyro knows that central station working means that the machinery is only employed at full load for a very small proportion of the 24 hours. A central station may be equipped with the best made and most efficient machinery for every day work, and yet when the results of a year's working are compared with those of other and equally well equipped stations, they may fall very far short of them and of the results which the promoters fondly expected. The reason of this is very often to be found in the way in which the machinery has been handled, and in the general management of the station, rather than in the machinery itself. In no business does success depend so much upon good management, method, and rigid economy as in central stations. The work is continuous, and in cases where there is no storage, the machinery must always be in motion. The first object of the engineer is to maintain a steady and continuous supply to his consumers, but this should not absorb his whole attention; his second object should be to produce and distribute this supply as cheaply as possible.

It would be impossible in the space at our disposal to enumerate the hundred and one ways in which this object can be attained; we will content ourselves, therefore, by pointing out a few of the most important.

The issuing of stores comes first. All stores, including coal, should be kept under lock and key, and be obtained only by presenting a demand note to the storekeeper, signed by the engineer on duty. The importance of this cannot be over-estimated. It checks waste, and immediately sets up between the watches a competition of economy. We have often regretfully referred to the fact that stokers and greasers as a rule seem to think that they are paid to put as much coal into the fires and waste as much oil as possible. The system of demand notes referred to at once puts a stop to this.

As we have already stated, the work is continuous; so also are the many little losses which at the end of the year total up to an enormous sum. Once a system of healthy rivalry is established between the watches, then leaky glands, steam joints and valves, pumps and drain cocks, boiler and condenser

tubes, quickly disappear, and although they may seem small in themselves, these taken collectively form a grave source of loss.

Having arranged the watches, it does not seem to us advisable to change the men about from one to the other; experience has proved that men get used to each other and work much better if allowed to remain in their own watches. Comprehensive report books should be employed in each department in which all work and tests are fully reported. These form excellent records, and are indispensable where an engineer wishes to keep thoroughly in touch with every detail. Each man should be provided with a time-sheet, on which is entered the work he has been employed on and the time spent.

It is a good plan to allot to each watch certain engines, dynamos, boilers, &c., to keep clean and in order, this insures each man taking an interest in keeping clean his particular machinery. Thorough cleanliness and punctuality should be enforced in every detail; men and machinery work better under these circumstances. It follows that if hard and fast rules are laid down in the engine room, sub-stations, &c., the same must apply to the engineer's office. Having now got complete records of all the work in every department, this information must be collected, say, once a week, analysed and tabulated, so that the engineer or manager can see at a glance what it has cost him to generate and distribute his current. In small towns there is no reason why the consumers' meters should not be read once a week, and the cost per Board of Trade unit metered, thus obtained. The management expenses being a fixed quantity, the amount per week is easily found, and by including this in the weekly analysis the table is practically complete, and will be found to be approximately correct at the end of the year, with the additional advantage of enabling the working of the station to be traced week by week. Of course, where varying discounts are allowed to consumers, it involves a little more work to calculate the average price per Board of Trade unit metered and to compare the week's revenue with the out of pocket expenses, but an engineer who has his work at heart will soon find means of arriving at an approximately correct average price for each week. Once a system is established on the lines we have endeavoured to prescribe, the enormous waste in coal, oil, and engine room stores will disappear, the working of the station will go on smoothly, machinery and men will always look bright, and a decided millenium hitherto unknown to central station engineers will have begun.

Thermometers as Electrometers or Ethometers.

Recently we called attention to the probable acceptance of gravitation in regard to matter, as we know it in the elements and ether, or electricity as we know it by its change of state or density, as an explanation of the phenomena of change exhibited in chemistry and electricity, and mechanical work we now add, and it was suggested that ether barometers were required as well as gas barometers. Electrometers we already have, and electroscopes we have, in which the gold-leaf electroscope may very usefully be considered as a form of ether capillariscope. If we consider a thermometer as an instrument or machine of matter capable of exhibiting marked change produced by expansion or contraction we shall be led to consider the cause of this expansion (direct cause at all events; the indirect cause leading to metaphysical considerations of the Hume and Coleridge school, not extended here, for obvious reasons, but profitable elsewhere), and an explanation appears to be in that electricity—calling the ether by that name—acting gravimetrically in mass separates the matter of the thermometer, exhibiting an apparent effect of repulsion of the matter of which the thermometer may be composed. We have no reason up to the present to say, or believe even, that a molecule of matter is either capable of expansion or compression, the one essential to the other; all we know is that they may be brought closer together or removed farther apart by the intervention, insinuation, or expulsion (produced by a stronger attraction) of the flux of ether. The centre of this earth must therefore lie in the line of greatest density to maintain both molecular and gravitational equilibrium. Then, if what is neither expansible nor compressible exhibits change in configuration, it must be due to addition or subtraction of what is apparently unweighable as matter by our present methods, and was for some time attributed to caloric. This caloric appears now as the ether, and if acting gravimetrically, squeezes itself, so to speak, by inherent attraction on to, and between, molecules of matter, that is attraction on to itself, equal to the other planetary force tending to prevent it, we see cause for expansion and the reverse when acting negatively; or to-it-that-hath-shall-be-given principle. Then a thermometer really becomes an ethometer from this point of view. From considerations in this direction we shall most likely arrive at the notion that absolute temperature means absolute molecular contact — free from ether interspersion — the realisation of which will depend upon the architecture of molecules. This seems a fascinating thought, accounting for cohesion, viscosity, and many other phenomena, chemical and mechanical, not hitherto very easily understandable, so that Descartes' logic with regard to matter was not so very far wrong, and it remains now to be seen what the mathematicians will do after being given this new flux to flounder in. Progress means simplification, and unless we get this we have not advanced a step, shuffle the factors as you may. We have now matter tangible and intangible (yet material) under the power of the *Will*, which may have some connection with "action at a distance."

Copper Electrolysis in a Vacuum.

A solution of copper sulphate does not conform rigorously to the form in which Faraday's law of electrolysis is generally expressed. It has been shown by Gray that the metallic deposit is heavier the higher the current density and the lower the temperature, an explanation being given in the fact that copper dissolves to a very appreciable, although variable, amount in solutions of copper sulphate. According to Schuster, it is probably the atmospheric oxygen present in the solution that causes this chemical corrosion. In view of this W. Gannon has sought to discover whether there is any difference between the weights of the two deposits in two copper voltameters, one of which is placed in a vacuum. Freshly made neutral copper sulphate solution was employed, and the electrolysis in one case was conducted first under reduced pressure, with the result that a heavier deposit was thrown down than was the case in a similar experiment, the pressure being that of the atmosphere; but the percentage difference was not constant. The addition of a little sulphuric acid to the voltameters caused this difference to be constant within experimental error. Under this condition, for current densities above 0·01 ampère per sq. cm. of active cathode, there is no practical difference in weight between the two deposits, but for lower densities the "vacuum deposit" is very appreciably higher than the "air deposit."

FLOCCULENT ELECTRO-DEPOSITIONS.

The *Elektrochem. Zeit.* contains a very interesting abstract, by Dr. A. Coehn, of Berlin, of the recent paper of Messrs. F. Mylius and O. Fromm, with regard to the dark, incoherent deposits formed at the cathode in the electrolysis of very dilute solutions, or, again, when zinc or other electro-positive metals are immersed in such solutions. The original experiments were made with a view to determining the difference of these two kinds of deposits, and to define their constitution.

The black flocculent mass which forms upon a zinc rod immersed in a solution of cupric sulphate is not copper, but a Cu-Zn compound, which when compressed mechanically into a metallic state exhibits the yellow colour of brass. The explanation is founded upon the hypothesis that in the combination (zinc, zincic sulphate, copper), a small quantity of zinc is deposited upon the copper, and this process is supposed to continue until a uniform potential is established, when the action may be assumed for a time to cease. The film of zinc thus deposited is next conceived to be absorbed by the copper, the original particles remaining at the surface to collect a further deposit, and the E.M.F. again being restored. If, therefore, a zinc rod is immersed in a solution of cupric sulphate, there occurs an interchange of copper and zinc particles, due to the formation of zincic sulphate; there is, in fact, a (zinc, zincic sulphate, copper) combination, as above. The authors suppose that the copper particles combine directly with the zinc. Then, in consequence of diffusion, the cupric sulphate again comes in contact with the zinc, and the whole process begins again.

The authors have tried to obtain similar metallic mixtures by immersing Zn, Cd, Pb, &c., in various solutions, and have succeeded in depositing compounds of more or less fixed constitution in the case of Cu_2 Cd, Au Cd_3, and Cu_3 Sn.

Dr. Coehn adds some remarks of his own upon these experiments. He points out that the condition necessary for the above hypothesis to hold is that the deposit shall be formed in a flocculent state; it is, therefore, not true for the ordinary action where the metal is deposited as a coherent mass upon the cathode, for when this occurs there is no trace of the metal of the cathode in the deposit, and he further adds that the deposit is always coherent when the rate of deposition does not exceed a certain limit. This rate is shown to depend upon the position, in the contact potential series, of the various elements and electrolytes concerned in the process. The further distant the immersed metal is from the solution, in this regard, the quicker and more vigorously will the action take place; if the metal is deposited with too great a current density it does not find time, so to speak, for the hardening to occur, but it falls in a flocculent mass as described by the authors. In sulphuric acid, the series given by Poggendorf is: Zn, Cd, Fe, Sn, Pb, Cu, Ag, Au, Pt. When the authors used Zn in solutions of Cu, Ag, Au, or Pt, the loose, mixed deposit was always obtained; whereas in the case of Pb, which is nearer to Zn in the list, the deposit consisted of a grey formation of pure lead. Similarly, Cd gave with Cu, Ag, Au, and Pt a flocculent, black deposit; whereas with Pb it produced a crystalline deposit of pure lead, which is also in accord with the remarks of Dr. Coehn. Iron produces a disintegrated mass in solutions containing salts of platinum, which is far on in the list; this mass consists largely of iron. But with copper solutions the deposit upon iron is almost free from particles of iron, and consists of nearly pure copper. No definite information is given with regard to the behaviour of iron in solutions of gold or silver; but tin, which is nearer than iron, forms a pulverous compound containing tin, in solutions of silver. The only exception seems to be the case of tin in a solution of copper; here the tin, which stands comparatively near to copper in the E.M.F. series, is deposited in the form of grey crystals, which the author considers to be a definite chemical compound, Sn Cu_3; lead deposits out of platinum solutions a powder containing a certain amount of lead; with gold solutions the deposit is black; in silver solutions there is at first a black deposit, owing to the presence of lead, but ultimately the lead seems to be replaced by more or less pure silver. In copper solutions the deposit is of a red brown colour, and contains lead; but in some former experiments of a similar kind only pure copper was obtained, and the authors attribute the other result to impurities in the lead. Copper gives flocculent deposits only with Au and Pt solutions. Silver is deposited upon it in pure crystals, unless the solution is very weak, in which case the copper takes a rosy tint. Dr. Coehn suggests that this method of colouring copper might be available in the art of metal decoration.

The assumption all through is that slow deposition is essential to hard deposits, and that this rate depends upon the relative positions of the elements of the action in the E.M.F. series. The second part of the experiments have reference to the further investigation of the black powders obtained in these processes, and an investigation of the hydrogen which is occluded in them.

SWINBURNE'S POTENTIOMETERS FOR ALTERNATING CURRENTS.

The calibration of alternating current ammeters and voltmeters is always a more difficult operation than the calibration of continuous instruments. Any method whereby ordinary instruments could be checked from time to time, and which might be used by manufacturers of instruments, is, therefore, of considerable interest.

Mr. Swinburne proposes to couple up his electrostatic ohmmeter in such a way as to use it as a potentiometer. Fig. 1 is a diagram of the arrangement; it is a null method,

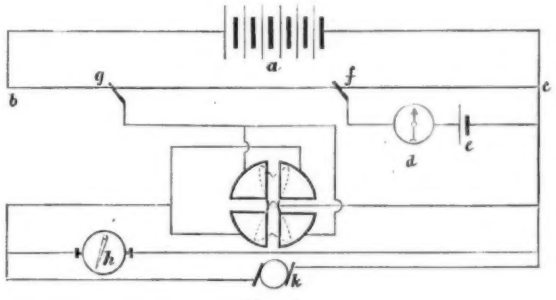


Fig. 1.

the needle being brought to zero, and designed as a differential galvanometer which shows whether the pressures are equal or not. The idea is to measure or balance an alternating pressure against a continuous pressure.

In the fig. 1, *a* is a battery maintaining a current in the resistance, *b*, *c*, which is regulated by an adjustable resistance, so that the standard cell, *e*, is balanced when its contact, *f*, is made at the mark corresponding to its electromotive force at the temperature at which it stands; *k* is an alternating dynamo, and *h* is the alternating voltmeter to be calibrated. The differential electrometer is connected up as shown. The double fishtail-shaped needle is pulled one way by a force varying as the square of the direct electromotive force, and the other way by a force varying as the square of the alternating pressure. The fishtail shape is necessary to ensure that the needle is in stable equilibrium when the forces are equal. Fig. 1 is, of course, a mere diagram. Resistance coils for adjustment are left out, and *b c* is shown as a stretched wire, whereas it is made up of resistance coils. As to sensitiveness, it depends on the construction of the electrometer; but, as already explained, there is no controlling force except that due to the suspending fibre. Take as an example an instrument that will indicate one volt when there is no pressure on the other side: it will admit of the comparison of two pressures of approximately 100 volts within one in ten thousand; and it will serve for comparing 2,000 volts within one in four million. To find the true zero of the instrument the four quadrants are connected together. The key for making this connection is not shown.

Accurate current measurements he proposes to make by a differential dynamometer. This instrument has two fixed and one movable coil. The continuous current goes through one fixed and the alternating through the other fixed coil,

and both go through the moving coil. There is no opposing spring to keep the moving coil in place, the moving coil being brought to zero between the two fixed coils, by their opposing forces being made equal. The arrangement is shown in fig. 2. The battery, *a*, supplies a direct current, which is measured by the fall of potential over the low resistance, *b*, and which passes in one of the fixed coils, *c*, and the moving coil, *d*. The alternating current circuit is led through the circuit, *f*, whose current is to be measured, and through the other fixed coil, *e*, and the moving coil, *d*. There is a slight error due to the whole of the alternating circuit being in shunt to the moving coil considered as part of the direct-current circuit, and *vice versâ*; but this is very minute. If *c* and *e* are wound close together so that there is no appreciable time-lag in any current induced in *c* by *e*, the small error due to the mutual induction of these coils cancels

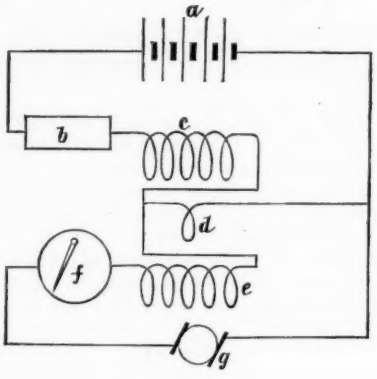


Fig. 2.

out. Of course a double dynamometer might be used, but then four mercury connections are needed. It is not unlikely that a method with no mercury contacts can be made available, and greater accuracy could then be attained.

The fishtail needle is, as far as we can learn, novel, and seems to be an excellent form for a zero method of measurement.

In a discussion on these instruments, Mr. Blakesley pointed out that the comparison made in the potentiometer was really one of *powers*, not actually a measurement of *pressures*, but as the powers are exactly as the pressures, that fact does not detract from the practical value of the method.

MECHANICAL DRAUGHT.

II.

The question of mechanically-produced draught was brought forward in a paper read before a recent meeting of the American Society of Mechanical Engineers by Mr. N. R. Roney, who states that the economy due to increased efficiency and capacity secured by the more rapid and energetic combustion of fuel is well established. This, of course, is perfectly true so long as the condition of the fire is equal to the intensity of the draught, but otherwise the result will be a loss by reason of an excess of air being used. Obviously, if by a better draught we are able to employ a less proportion of air—and this is the case under proper conditions—then the furnace temperature must necessarily be higher and the transfer of heat more rapid, while, at the same time, the final temperature, even if the same as with natural draught, will be a less ratio of the initial temperature; and, further, the waste gases will be less in volume. The saving comes in all round.

Mr. Roney appears to be of opinion that a high furnace temperature is more especially necessary for boilers of the water-tube type, because otherwise the gases are apt to pass away unburned, owing to the too rapid cooling action of the water tubes, but he conveys a wrong impression when he says that a strong draught is necessary to deliver an abundant supply of oxygen. This is not so. In an ordinary furnace the oxygen is always too abundant. The function of a strong draught is to force air through a fire of thickness sufficient to utilise the air, whether such forcing be by means of fans, to increase the pressure of air entering a furnace, or to reduce the resistance at the chimney end by helping forward the waste gases.

Referring to the use of economisers or flue-feed heaters, it is stated that valuable as these are they form a very serious obstruction to the draught, and no well-informed engineer would think of adding one without making provision for this, and it is not good engineering to employ an economiser where the chimney is less than 200 feet high. Upon this point there may be two opinions, and the other opinion is, that where it can be got in, the economiser might very well be made wider and shorter, so as to provide a much larger area of flue-way and a less distance to travel, with correspondingly reduced velocity of gases, and, therefore, equal contact with the pipe surfaces. Lancashire practice is, we know, in line with Mr. Roney's figures, and a standard chimney is 200 feet high, and the economiser is an obstruction; but is it not likely that economisers have been made too narrow from the fact that they were very often placed in the space formerly occupied by a boiler? However, Mr. Roney would abolish the tall chimney, both because of space and cost. A 250-feet chimney will require a foundation at least 30 feet square, and this is an objection where space is limited. A minimum temperature is required, and this places a limit upon the extension of the economiser surface, and a chimney must be built too large for present purposes with a view to future extensions of business, as it cannot well be added to. A chimney is subject to variations in the atmosphere, and under certain states of the atmosphere it may be seriously crippled. None of these objections apply to mechanical draught. The first cost of the apparatus is less than that of an equivalent chimney—75, or even 80 per cent. less according to conditions, and very little foundation is needed for the fan and short stack pipe, while the space saved can be filled by extra economiser pipes.

In the illustration accompanying the paper, the economiser and fan are shown placed on a girder floor, below which are located feed pump and condenser, &c. The fan draws through the economiser and delivers directly upwards at the iron stack pipe. It is driven by its own independent engine, which also drives the scrapers of the economiser. Placed at the nearest point to the chimney, the fan will not be exposed to any specially destructive temperature, especially as the waste gases ought to be pretty well robbed of their heat to justify the use of a fan, for the draught is entirely independent of the chimney temperature. Of course, where there is a chimney, and it is not necessary to remove it to save the space it occupies, the fan can as well discharge into it, and it will perform some duty. We do entirely agree with the author that economisers have received a bad name because of their faulty application in so many places, and the limits they place on the draught. With a fan, the sudden call for steam that is often made in an electric light station can be replied to with fair promptitude by adding to the fan speed, but this does not, of course, absolve one from the necessity of affording a fair water space in the boilers.

Double fans are recommended so as to have the whole in duplicate. On this point it would appear that some extra expense is incurred, and that if there is an objection to the expense of duplicating there might be two fans each of about two-thirds the required capacity. Working together slowly they would be ample. In case of one breaking down the other could do the work of running at a specially high speed to tide over the repairs. Fans are not large consumers of power, but we would point out that with a fan draught the fan must be the damper. There must be no running of a fan at full speed with shut down dampers, but the speed of the fan must be regulated to the demand for steam, and this is most easy to effect, the variation of the steam pressure controlling and varying the fan speed. To illustrate the small power called for by exhaust fans, the author instances a plant for 6,000 I.H.P. with full size duplicate fans, each sufficient to supply air for 7,500 H.P. The power to drive one fan was only six-tenths of 1 per cent. of the boiler horse-power, or, estimated in coal per horse-power hour with coal at 12s., the fuel cost of driving the fan for one year was 2 per cent. of the estimated cost of the chimney originally planned for the duty.

In another case for 2,000 H.P., the fans call for less than 10 H.P., or under half of 1 per cent. This is at the Market Street station of the Philadelphia Traction Company, on Thirty-third Street.

A table is given showing some results obtained at nine places. The average temperature of the gases entering the economiser is 520°; that of the smoke stack 265°, the fuel saving averaging nearly 14½ per cent., but unfortunately no information is given as to the performances in which this percentage was gained, nor the ratio of economiser to boiler heating surfaces.

Illustrations are given showing the arrangement of the Thirteenth Street station of the Philadelphia Traction Company, containing 20 water-tube boilers arranged in two rows, discharging into two flues, each of which discharges through an economiser to a pair of fans. The fan engines are in duplicate, and arranged so that either engine can drive any one or more of the four fans, and any two fans will deal with the gases from all 20 boilers. It had been originally intended to provide two chimneys, 200 feet high and 11 feet internal diameter.

THE INDUSTRIAL EFFICIENCY OF ELECTRIC ACCUMULATORS.

We are indebted to the management of the Sector of the Place Clichy, says *L'Industrie Electrique*, for the statement of the results observed since the commencement of the current year, as to the industrial efficiencies obtained with the two large batteries of Laurent-Cély accumulators, supplied by the Société pour le travail électrique des Métaux, and installed at the station in the Rue des Dames.

We think it will be interesting to set before our readers these results, which relate to batteries in use for the ordinary service and working under normal conditions. The two batteries are identical, and each consists of 250 elements. Each element consists of 23 plates, measuring 45 centimetres along the side; they are suspended from the top. We call attention to this improvement which, like others introduced into this sector, has given excellent results, both as regards the preservation of the plates and the increased efficiency. The thickness of the positive plates is 8 millimetres, and that of the negative plates 6 millimetres. The total weight of the plates constituting one element is 150 kg.

The condition of working of these elements is as follows:

	Ampères.	Capacity in ampère hours.
Normal working rate ...	250	2,000
Extra „	340	1,700
Maximum „	450	1,350

The service of the batteries is regulated in the following manner:

The two batteries are worked alternately every day, and their charge and discharge is recorded for each on a daily bulletin. Readings are taken every 20 minutes, not only for the main body of the battery, but also for the reducing apparatus. The daily bulletin, which we need not reproduce here, is divided into two columns: charge and discharge.

For the charge, a record is kept of the difference of potential, the current, the volts, the power, and the energy supplied respectively by the system and by the pressure elevator. The number of ampères and the number of ampère-hours are, of course, the same for the system and the tension elevator. The quantity and the energy are calculated every hour, and carried out consequently in three lines, since there are three readings per hour. In another column are summed up the two differences of potential and the two quantities of energy. By summing up for the whole day the total of this last column, and also that of one of the two columns of ampère hours, we get the total quantity of energy and the quantity of electricity supplied to the battery.

For the discharge, also, a record is kept of the difference of potential, the current, the volts, the power and the energy, the current and the energy being recorded every hour.

In each of the two main divisions of the daily bulletin, special columns headed "Figures of the reducing apparatus" enable the rate of charge and discharge of the reducing apparatus to be noted. These figures are most useful for showing the best mode of employment of these accumulators, which are placed under special conditions of working.

By taking the totals of each column, therefore, we can easily calculate the quantity of electricity (in ampère hours) given out:—

1. By the body of the battery.
2. By each reducing apparatus.

An ampère-hour discharge efficiency of 85 per cent. for these different outputs is adopted, and thus the number of ampère hours which will be required for the subsequent charge is fixed:—

1. To each of the reducing apparatus.
2. To the body of the battery.

The reducing apparatus are withdrawn in succession from the circuit as soon as their charge is completed. Thus they are neither over-charged nor incompletely charged. This rule, which can easily be followed, requires no additional staff; it simply requires a little attention from the man that attends to the board, but it has an important influence on the total efficiency. It is rigorously carried out at the sector of the Place Clichy.

The difference of potential at the terminals, both during the charge and the discharge is measured at the terminals of the battery like the output, *i.e.*, every 20 minutes. After each measurement the output is multiplied by the difference of potential, and the sum of these different products enables us to find the outputs in watt hours during the discharge, and also the energy in watt hours restored at the following charge. The readings being taken every 20 minutes, each of the sums found must evidently be divided by three, in order to obtain the corresponding energy in watt hours.

Month.	Discharge in watt hours.			Charge in watt hours.		
	Battery I.	Battery II.	Total.	Battery I.	Battery II.	Total.
January	13,066,699	10,450,772	23,517,471	19,746,237	16,030,473	35,776,710
February	10,648,868	9,946,208	20,595,076	15,522,182	14,760,667	30,282,849
March	10,106,115	9,890,599	19,996,714	14,483,537	14,160,803	28,644,340
April	10,818,501	9,970,426	20,788,927	15,377,637	14,405,681	29,783,318
May	12,631,008	11,151,977	23,782,985	17,573,584	15,515,963	33,089,547
Totals	57,271,191	51,409,982	108,681,173	82,703,177	74,873,587	157,576,764

During the progress of the mechanical service of the station, the lighting of the sector is first provided for, and the supplementary motive power serves for the charging of the batteries, including the reducing apparatus. In order to obtain at the terminals of the battery the difference of potential required for the charging in series with the large dynamos used for lighting, a supplementary dynamo, termed the pressure elevator, is added. The two batteries provide for the entire service of the sector while the machines are stopped; they may, in case the output becomes too great to be supplied by one of them alone, be connected in parallel. This is often done from midnight to one o'clock, at which time the output is considerable and exceeds the normal rate of the batteries.

The sum of each of the daily sheets is carried out on a register. We give the figures recorded each month on this register from January 1st to May 31st, 1894. We thus get the results obtained during five months' working.

From this table we see that the efficiency in energy is:—

In January	65·5 per cent.
In February	67·9 „
In March	70·0 „
In April	69·9 „
In May	71·8 „

The total for the five months amounts to 108,681,175 watt hours, given out during the discharge by the two batteries, and to 157,576,764 watt hours restored at the charge, which corresponds to a total efficiency in energy of 69 per cent. As we see by the table the monthly efficiencies after the month of January increase progressively.

The following little table sums up the mean quantity of electricity given out daily during the first five months of the year.

The mean output since the beginning of the year is 1,500 ampère hours. It represents 88 per cent. of the capacity at the high rate of discharge, 340 ampères, which is often attained.

Daily Output in Ampere Hours.

Month.	Battery I.	Battery II.	Total.	Mean output.
January ...	1,728	1,678	$\frac{3,406}{2}$	1,703
February ...	1,720	1,600	$\frac{3,320}{2}$	1,660
March ...	1,500	1,375	$\frac{2,875}{2}$	1,438
April ...	1,540	1,433	$\frac{2,973}{2}$	1,486
May	1,302	1,144	$\frac{2,446}{2}$	1,223
Totals ...	7,790	7,230	$\frac{15,020}{2}$	$\frac{7,510}{5}$

Mean of the five months, 1,502 ampère hours.

It also represents 75 per cent. of the capacity at the normal rate of 250 ampères, which is very often exceeded.

In any case, the battery gives out each day at least 70 per cent. of its capacity, which, if we can judge by the results obtained, places it in very good conditions as to efficiency.

These results can very easily be obtained at the trials with lead accumulators of any type. We, however, consider them very interesting, because they represent the industrial practical work of five months, because they have been obtained under the conditions of actual service, and because they relate to a considerable quantity of energy given out and restored. They show the great care bestowed upon the working of the service of the sector of the Place Clichy.

CONDUCTIVITY BALANCE.

The necessity of knowing more about the qualities of copper bars and wires of large size grows with the demand for conductors of the very lowest possible resistance, and with the issue of specifications of more and more stringent nature.

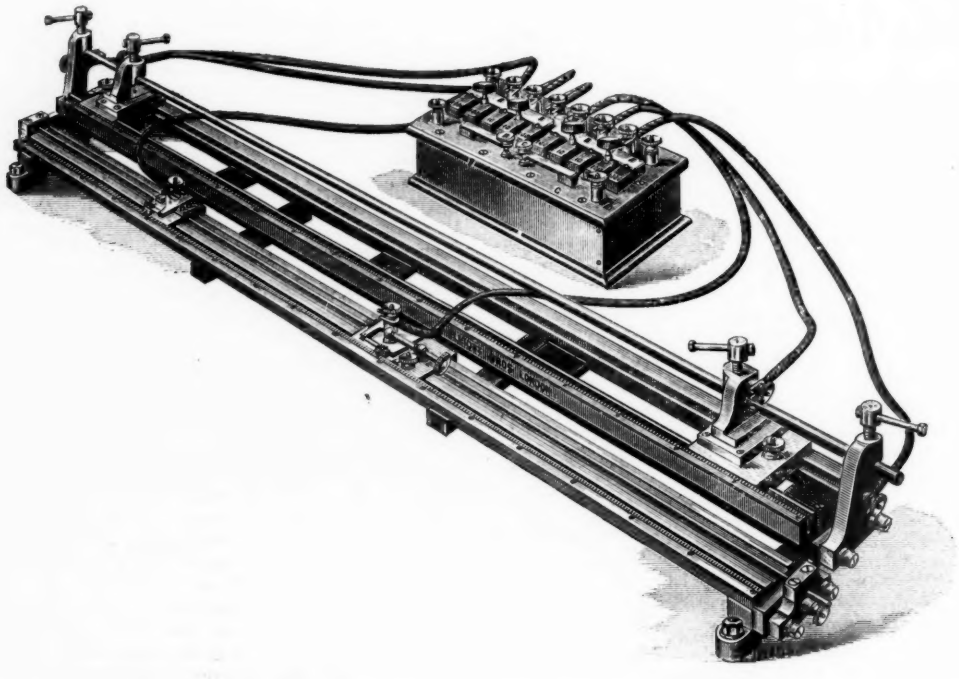
A fine example of a piece of apparatus just completed by Messrs. Elliott Bros. is now illustrated, and the design which they have worked out appears to be very suitable for workshop use for testing large samples with the greatest possible accuracy.

The apparatus is on the lines of the well known Thomson bridge, and the diagram shows the way in which the apparatus is joined up; the method is a fall of potential one, the wire to be measured being placed in series with the standard length.

Resistances are inserted in the wires leading from the points of contact, so as to eliminate the contact resistance; and these resistances are arranged in a separate box, as shown, and are capable of being connected up in various ratios, like the proportion arms in an ordinary Wheatstone bridge; this enables the range of the instrument to be very considerably increased.

The conductivity balance is arranged on a strong cast-iron frame, at the back of which two clamps run in slides, and two clamps at the ends form the battery connections to the bar of copper under test—in the size now made, bars one metre long, and three-quarters of an inch in diameter can be dealt with. The sliding clamps are provided with sharp knife edges, and a scale and vernier allows the distance between them to be very accurately determined. Laid along a strip of insulating material in the front of the apparatus, is a standard wire of platinoid, the total resistance of which is about ·03 ohm; two clamps slide along over this wire, the contacts being pressed against the wire by strong springs when required, and a fine adjustment and vernier scale for measuring is provided.

The battery and galvanometer keys are fixed on the box



containing the ratio coils, and the arrangements are very compact and convenient.

When we saw the instrument under test, a resistance of $\frac{1}{200,000}$ ohm was easily measured. The workmanship of the whole apparatus is of a very high character, and the apparatus seems to us to fulfil a long felt want among copper manufacturers.

The particular piece of apparatus illustrated was made to the order of Mr. J. Patchet, of the Shropshire Iron Works Company, who are taking up the question of the very highest conductivity copper very keenly and with great success.

NOTES ON THE DESIGN OF LARGE ALTERNATORS.

By RANKIN KENNEDY.

From time to time, in the electrical periodicals, we are treated to excellent illustrations of the various alternators put down for generators at central stations, and elsewhere; but very seldom do we come across any discussion or criticism of their design. Since these machines are now made by mechanical engineers, the construction is the best the design will allow of.

Some recent designs prominently brought forward are worthy of examination, and the designs of the various types commonly in use may be compared from various points of view with profit.

In these notes I do not refer to any particular alternator or maker, except where named particularly; for as several makers make the same alternators with but slight modifications in unimportant details, it would be unfair to refer to these alternators as Messrs. This or Messrs. That's alternator. The alternator is such an old invention, that nobody at this date can lay claim to any particular design; the claims now held can only be for small modifications; to these we do not intend to refer; these notes refer only to the broad principles governing the design of dynamo-electric generators; in fact, the arguments are equally applicable to continuous as well as to alternating generators.

The design of large alternators is, to some extent, controlled by the characteristics of the motor applied for driving them if they are direct coupled; if they are to be belt or rope driven, this consideration is, however, of not much importance. For present purposes we may neglect the necessities of the cases where different engines are to be used, and confine the attention to electro-magnetic matters only.

The problem in designing large alternators is to produce a machine in which, first, the magnetic flux will gradually rise and fall through the generating coils; second, the magnetic flux shall be steady and constant through the magnets and the core of the armature; third, the magnetic leakage shall be a minimum, and it should be constant; fourth, hysteresis and eddy currents should be a minimum.

It goes without saying that the design must, in a thoroughly good mechanical manner, provide against all the strains, mechanical and magnetic, set up in the machine at full load and full speed.

The machines presently in use are all based upon the three old types of machines; the Siemens machine, with flat coils in a circle revolving between two crowns of opposite poles, the number of coils and fields being equal; the Gramme alternator, with a ring core carrying coils, surrounding a radial field magnet; the Lontin alternator, with radial field and radial armature projections carrying the coils.

At the present day the first type still holds its own, in some cases with but little modification, and is in use in some of our largest installations; in the four requirements of a good design are as well met as they can practically be.

1. The flux through the coils rises gradually, the permeability being constant in the armature.

2. The magnetic flux through the field is steady.

3. The magnetic leakage is steady, a fact proved by the non-heating of the poles.

4. There are no laminated cores, hence the hysteresis loss is a minimum, and as the coils consist of flat ribbons, presenting a narrow edge to the flux, the eddy currents are also a minimum.

In this type the magnetic leakage is not a minimum, for the alternate poles are close together; but on the other hand, in most other types, it is quite as great.

With these points in its favour, there is little wonder that this type has survived, and with modifications in detail, is likely to survive some of the mongrel types promoted more recently.

The most striking modification of it is a good design by Mordey, in which the leakage in the field is reduced to a minimum, and the construction of the field much simplified. This design is familiar, and much used from its high efficiency. The coils are double the number of poles, and all the poles on one side are N, and all the poles on the other S, so one coil excites them all, and as opposite poles do not lie adjacent to each other, there is no appreciable leakage. It fulfils the four requirements of a good design. Many other machines of this general type, originated by Siemens, will occur to the engineer.

One great point in their construction strikes the practical engineer most forcibly; laminated structures there are none. To the engineer, laminations are abhorrent in a design for a large machine. Large laminated structures are expensive to build, both in material and labour; hence machines in which we have no reason to build up laminated pieces are, other things being equal, from the manufacturer's point of view preferable.

The next type we may notice is the revolving radial poled field magnet, with a laminated core surrounding it, and carrying the coils. A modification of this type is the laminated flat ring type, carrying coils between two crowns of magnets. Gramme originated this type. It comes next best to the Siemens type, but it labours under the disadvantages of requiring a laminated core. This requirement means great expense in building, and introduces hysteresis losses, and to some extent also eddy current losses, if the coils are wound on a smooth core; and if they are wound on a toothed core, or through holes in the core, we introduce a variable flux through the field, but otherwise it fulfils the requirements of our good design.

The third type, that of Lontin's, is at present a great favourite with some makers, and has been adopted in this country at a few places. In the original machine the leakage, hysteresis and eddy currents were so great, that it took more power to drive it when on open external circuit than when fully loaded. Now, it is built up with a laminated field magnet, and a laminated armature core, so that although it yet possesses all the vices of the original machine, they exist in a much lesser degree. The construction consists in fixing outward projecting poles, well laminated on the periphery of a large wheel; these carry the exciting coils. Concentric with this wheel is a massive frame, carrying a circle of laminated blocks, with inward projecting polar extensions carrying the armature coils. Now, with such a construction, none of the requirements of a good design are obtained.

1. The flux through the coils is not gradually increased and decreased, hence a bad pressure curve is produced.

2. The magnetic flux through the field is pulsating, hence hysteresis and eddy currents are set up.

3. The magnetic leakage between the poles on both field and armature is greater than in other designs.

4. The enormous amount of lamination required makes it very expensive, and does not after all cleanse the machine of its original sins.

And another serious characteristic of such machines in which the magnetic flux fluctuates through the field magnet structure is that one referred to already, as peculiar to the old Lontin, the losses increase as the load decreases.

Careful tests of alternators, even of smaller sizes, clearly prove the fact that the machine, without laminations, is the superior design, and this stands to reason with our present day knowledge of continuous current dynamos and our experience with transformers, both of which teach us the importance of avoiding all fluctuations both in magnets and coils, except in the places and at times designed for the generation of useful pressures.

No design in which the magnetic flux varies in the field can be considered as satisfactory for large machines.

The Lontin type, when well laminated, may give a higher output than the other types, but that is a doubtful advantage.

While we have reached an approach to finality in the designs of continuous current machines of large sizes, and their good and bad points, are well known, it would seem, from the fact that such a variety of alternators are still made, that their design is not so well understood, and it is surprising how little is heard of actual tests of their efficiency, considering how much is claimed for them. If, in some of the descriptions, a few indicator diagrams of the engines, driving them at various loads, were substituted for the photos of the exterior of these machines, there can be little doubt that the conclusions drawn from these notes would be confirmed in regard to the difference between the types.

O

NOTES ON THE STEAM TURBINE.

By KENELM EDGCUMBE.

Although it is only of comparatively late years that the steam turbine has received much attention, it was, in actual fact, the first form of steam engine to be devised—that is, if we may apply so dignified a name to the eolipile, described in the second century, B.C., by Hero of Alexandria. It is only natural, however, that the first practical application of the reaction principle here involved, should have been to the utilisation of water power, when, about a century and a-half ago, Dr. Barker devised a hydraulic motor called after the inventor, "Barker's Mill." At the present day, however, it is more usual to find in use hydraulic turbines of the "direct flow" class. The chief distinction between the two types may be summed up by saying, that in the former case the jets themselves revolve by "reaction" in the opposite direction to the outflowing water, whereas in the latter, the stream is directed against movable blades, which then revolve by the "direct action" of the water against them in the same direction as the flow. Except for losses due to friction and to water passing over the ends of the blades without acting on them, it would evidently not be difficult to obtain a fairly high efficiency with such a motor.

The substitution of steam for water as a source of energy is, however, a very different matter. In the one case the energy stored up is purely mechanical, while in that of steam it is thermal, and must be converted into mechanical energy before it can be applied to any useful purpose. The number of heat units required to generate a pound of steam from water at 32° F. is expressed as the sum of the sensible and latent heats, or

$$H = S + L.$$

Since a B.Th.U. is the quantity of heat required to raise a pound of water through 1° at its point of greatest density, and as the specific heat is practically constant, S may be represented in B.Th.U. by the number of degrees through which it is required to raise the water to the boiling point; L can be further split up into internal and external work, performed during evaporation, but as we are only concerned with the total heat this may be neglected. Regnault gives the following approximate formula for steam obtained from water at 32° F., and boiling at a temperature t, depending on the pressure. Total heat

$$H = 1{,}082{\cdot}4 + 0{\cdot}3\,t.$$

Steam at atmospheric pressure (14·7 lbs. per sq. inch) occupies a volume more than 1,600 times as great as that of the water from which it was generated. It can, therefore, be caused to perform work, on a suitable piston, placed in its path as it flows into the atmosphere. This was, in fact, the method employed in the early forms of engine. Watt, however, showed that more work could be extracted by cutting off the supply after the piston had completed a quarter, say, of its path, and allowing the stroke to be completed by the expansion of the imprisoned steam. As it expands there will be a fall of pressure from two causes: firstly, the increase of volume results in a corresponding decrease of pressure, which is further augmented by the condensation which arises from the extraction of heat in the form of external work. This condensation goes on to just such an extent as to leave the remaining vapour at a pressure corresponding to the temperature in the cylinder at the moment. In order to extract all the possible work from the steam, it must obviously be allowed to expand till its pressure is zero. Now the temperature corresponding to such a pressure is given by Maxwell as − 459·13° F., and although some of the assumptions on which this value of the "absolute zero" depends for its accuracy, have been lately somewhat called in question, it will be quite sufficient, for our purpose, to regard it as − 460°.

A fall of temperature, such as is here implied, is, however, quite out of the question, and we can never, therefore, even with a "perfect" engine, hope to regain all the energy imparted to the steam. The maximum efficiency theoretically possible, may be expressed as the ratio of the fall of temperature actually available to the ideal fall, that is to say down to − 460°, or, if T represent the absolute temperature of admission, and t that of exhaust, the efficiency would be

$$\eta = \frac{T - t}{T}.$$

The minimum value of t is determined by the temperature of the coldest substance available—in practice, water—and may be taken at from 60° to 100°. In order to increase η, the only other alternative is, therefore, to raise T. Here, too, however, a practical limit is soon reached, for since with any increase of temperature the pressure also rises, not only must a stronger, and therefore more costly, boiler, &c., be employed, but also the losses due to radiation are increased, while, on the other hand, the improvement in efficiency is but slow at the higher temperatures. Under these circumstances, taking 180 lbs. (abs.) as the initial pressure, and ½ lb. that of exhaust, we shall have T = 374° (or 834° abs.) and t = 80° (or 540° abs.), giving a possible efficiency

$$\eta = \frac{834 - 540}{834} = 35 \text{ per cent.}$$

As may be imagined, the results obtained in practice are greatly inferior to what should be theoretically possible with the given range of temperature. For example, a consumption of 15 lbs. of steam per H.P. hour at 150 lbs. pressure, corresponds to η = 15 per cent.

It may be worth while to briefly consider the chief causes of this inefficiency, and to compare their relative importance in steam engines and turbines. We alluded above to the condensation in the cylinder, and found it to be a necessary accompaniment of the expansion of saturated steam. However this may be, it is most objectionable from a practical point of view. This condensation is, of course, greatly increased by the steam flowing, as it must, into a cylinder which has just been cooled down by expansion, to the comparatively low temperature of the exhaust. To obviate this great loss of available heat several methods are employed. Expansion may be completed in two, three, or even four cylinders, this reducing the range of temperature between admission and exhaust of each. This method adds considerably to the complication of the mechanism, and therefore to the mechanical friction, as well as causing a drop of steam pressure between the cylinders. Another method is to give the steam several degrees of super-heat before entering the cylinder, or again, it may be avoided by surrounding it with a "jacket" of live steam. In this case condensation, of course, takes place in the jacket instead of in the cylinder. In the turbine, since, owing to its construction, every part is maintained at a constant temperature throughout, no such precautions are necessary. Both super-heating and compounding have, however, duties to perform in this case also. The former will be considered later, when we come to discuss the various forms of motor. The chief office of the latter is to reduce

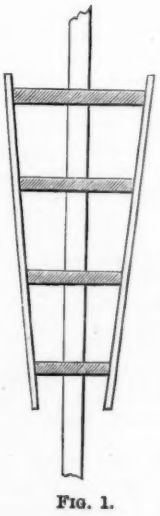


Fig. 1.

the velocity of the steam, and therefore that of the blades, and herein lies the chief distinction between the steam and water turbine, for with the latter, any compounding would be the reverse of advantageous. A further advantage of its continuous action is the entire absence of all "clearance" spaces, which, in the cylinder engine, have first to be filled with steam up to the initial pressure before the cut-off can be effected. This not only reducing greatly the ratio of

expansion, but also preventing the performance of admission work.

It may be asked, how it is possible for the steam to work expansively without intermittent admission. It will be seen from fig. 1, that were it possible to construct a single-acting engine, having a conical cylinder, with pistons at fixed distances apart, and so arranged as to fit accurately throughout the whole stroke, such expansion would be possible. This is, in fact, the case with the steam turbine, which has the further advantage of being always on the down stroke. The conical form of the cylinder corresponds to an enlargement of the blades and passages towards the low pressure end.

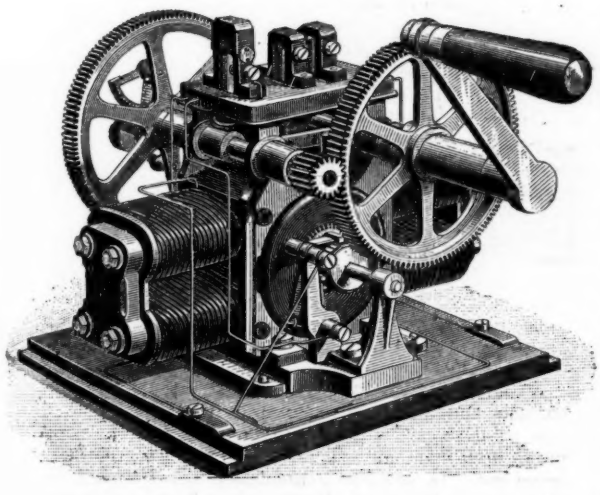
(To be continued.)

AN ELECTRIC SYSTEM OF SHOT-FIRING IN MINES.

With the introduction of new explosive agents has arisen a demand for improved means of firing them, and such means constitute an important part of the appliances used in blasting operations as carried on in mines and quarries. The conditions which any such means must fulfil have been defined by André as follows:—(1.) That it shall fire the charge with certainty. (2.) That it shall allow the person whose duty it is to explode the charge to be at a safe distance away when the explosion takes place. (3.) That it shall be practically suitable and applicable to all situations. (4.) That it shall be obtainable at a low cost. Electricity fulfils all these conditions.

There are, however, other advantages which the employment of electricity offers. Next to the safety of the operator comes the greatly increased effect of the explosion when a number of charges are fired simultaneously. Further, the facility afforded in firing charges under water or in damp situations is a feature in the use of this agent, which is of great practical importance.

Broadly speaking, an electric fuse consists of a charge of some explosive substance suitably placed in the circuit of an electric current, which substance is to be acted upon by the current to produce an explosion. The mode in which the current is made to act, depends upon the nature of the source of electricity, which may be high pressure or low pressure. In the former case the spark is made to leap across a break in the circuit, at which point is placed some of the explosive. In the latter a platinum bridge is embedded in the explosive and is brought to incandescence by the passage of the current and the fuse thus fired, or, more generally, a portion of the explosive itself forms the bridge.



In Germany, America, and in France, machines for firing fuses in mines electrically, are used to a large extent. The latest form of machine was recently described in *L'Industrie Electrique*, and we reproduce a general view of it. Practically the machine is a tetrapolar dynamo producing an alternating current. On an axis, or revolving between the four pole pieces, are two annular armatures, one of which gives a continuous current, which serves to excite the magnetic field, whilst the other gives an alternating current. The mechanism permits the armature to attain an angular velocity of 4,000 turns per minute. At the instant this speed is reached the circuit is made, and the fuse with which the machine is connected in the usual way, is fired. The closing of the circuit is thus automatic, and takes place when a sufficient amount of kinetic energy has been accumulated in the revolving parts of the machine. These machines appear to be specially designed for use with the Manet fuses.

A SECOND KEELY.

We have received a most extraordinary communication, type-written, in the vilest composition, and signed by one F. W. Mason, of 39, Corporation Row, Clerkenwell. So illiterate is the style that it is difficult to gather the meaning without close reading, but the object of the so-called invention to which our attention is invited is, or we are intended to understand, some means of arranging the steam engine with an oxyhydrogen apparatus for the purpose of manufacturing power. Needless to say the whole affair seems like an attempt to mislead, but, by whomsoever got up, it is a very poor attempt. The promoter has just sufficient acquaintance with a smattering of chemical knowledge to string together a few technical terms in what he evidently thinks is a flaming style, but is too crassly ignorant to perceive the utter rubbish he has written. To quote his own words, spelling and composition:—"In the present inventions by means of a special chemical, contained in a series of automatically regulated ignition tubes, the steam flowing from the exhaust instead, of has is usual, being treated by a condensor system, is forced through these tubes and their split up (not into one) but its two component gases oxygen, and hydrogen, both gases independently and separate are obtained, and conducted to suitable reservoirs . . . . to the furnace . . . . where . . . . the essential heat is obtained, thus the ideal engine would run parodoxical on its own water not requiring fuel beyond."

The foregoing is thus a claim by means of a *special chemical* to run a heat engine on a closed cycle, the heat to be obtained from the combustion of the gaseous constituents of the exhaust steam which is to be split up in *automatically regulated ignition tubes*. We are carefully told, be it noted, that the exhaust is not to be decomposed into *one* constituent, and this is very kind of Mr. F. W. Mason, who very candidly states that "this may sound like a piece of fiction from Jules Verne." We can assure him it does not so sound. Whether this genius has a client for whom he is working we cannot say. There may be other persons in the world of Mrs. Bloomfield Moore's wondrous credulity.

It will be observed in the few lines we have reproduced from his two page circular letter how he rings the changes on the stock phrases of the mechanical ignoramus: the "special chemical." How suspicious are these *specials*: the "automatically regulated tubes:" that blessed word "component;" but how does he get the "parodoxical?" It is, perhaps, taking the affair too seriously to lift even a warning voice against this ignorant pretender; nor wou'd we do so were it not that experience has shown that even the ignorance of such men is often set down as a sort of evidence of their genius too transcendental to be comprehended of the vulgar. The life of Keely has shown how people may be misled in the face of the most obvious impossibilities. At the close of his effusion, Mason claims that no *savant* can proclaim what is, or what is not, possible.

A more blatant example of ignorance than this letter we never saw. It is intended to be high sounding, and the words used are of the high sounding class, but the composition is that of "English as she is spoke," so much so as to lead to the impression that this Mason must be a foreigner.

Apart from its misleading character, the document is comical to a degree. We may say, "manifestably" so. "But be it howsoever anyway" as its author says, we feel sure he would

do well to be advised to cease from any further robbery of Nature, such as he grandiloquently terms his present attempt on mankind, and to find something else on which to work than a perpetual motion idea.

THE WADDELL-ENTZ DYNAMO AND MOTOR.

These machines, which are to be introduced by a well-known firm into this country, vary in size from ¼ kw. to 80 kw., and the motors only differ from the dynamos in not having the field compounded, the street car motor excepted, which is of a special type. Figs. 1, 2, and 3 show very clearly the

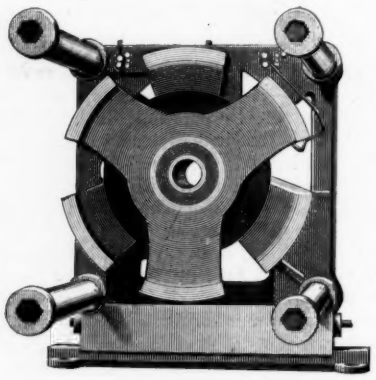


Fig. 1.

armature shaft the ends form equally spaced symmetrical poles. The poles connected to one spider are all norths, and those connected to the other all souths, but from the arrangement the norths and souths ends alternate beneath the armature. In the smaller dynamos a spider has two arms, or rather a single arm, projecting on each side of the magnet core, making consequently four poles. In the largest size the spiders have five arms and ten poles. The armature is

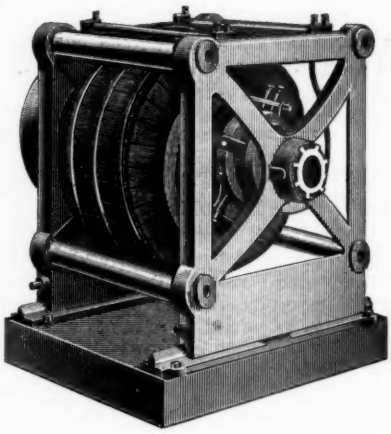


Fig. 2.

shown in fig. 3. It is built up of soft sheet-iron segments which are held together by a metal ring on each side, the brass bolts of which do not pass through, but clear, the outside of the armature, thus completely avoiding Foucault

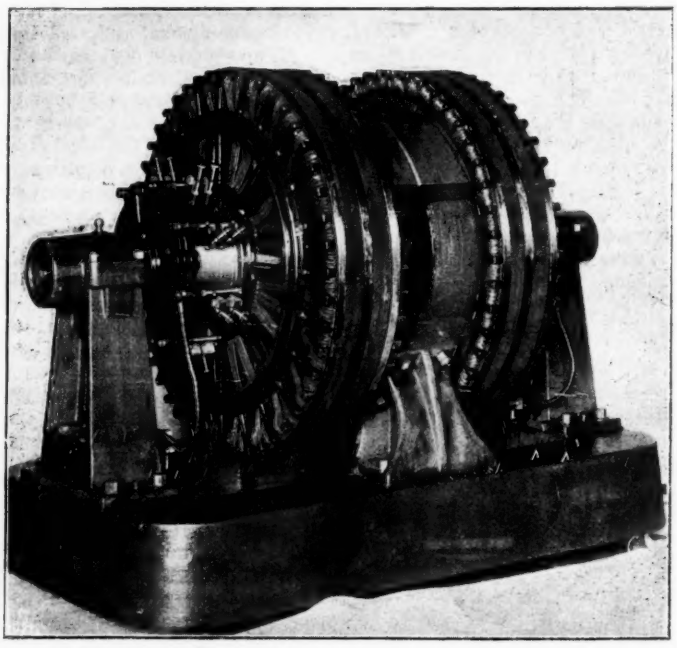


Fig. 4.

construction. There is only one field coil, which is central. The field frame consists of two spiders; one of these carries the magnet core and the other fits on the turned end of this core. The field coil is entirely shielded from injury by the two spiders, which together completely enclose it. It may be here remarked that the commutator is similarly shielded by the outer frame, but in which there are ample openings for adjustment of the brushes if necessary. The ends of the spider arms are turned at right angles, and when in place these alternate, so that viewed at right angles to the currents and also serving to space the Gramme winding. The greatest care is given to insulation, and the company prides itself upon its immunity from burnt out or defective armatures. In order to be absolutely sure in regard to the insulation of the wires, all wire is bought bare and covered in the factory. A special process is used in regard to insulating the armature frame, all moisture being withdrawn from the covering by passing a hot iron over it.

Great attention is also given in the construction of the commutators, the segments of which are covered on the

bottom and sides with a continuous sheet of mica, thus preventing any possible defect at the bottom of the segments.

The poles of the field are turned true, and the armature so truly made that when in place over the poles the air space can be made very small.

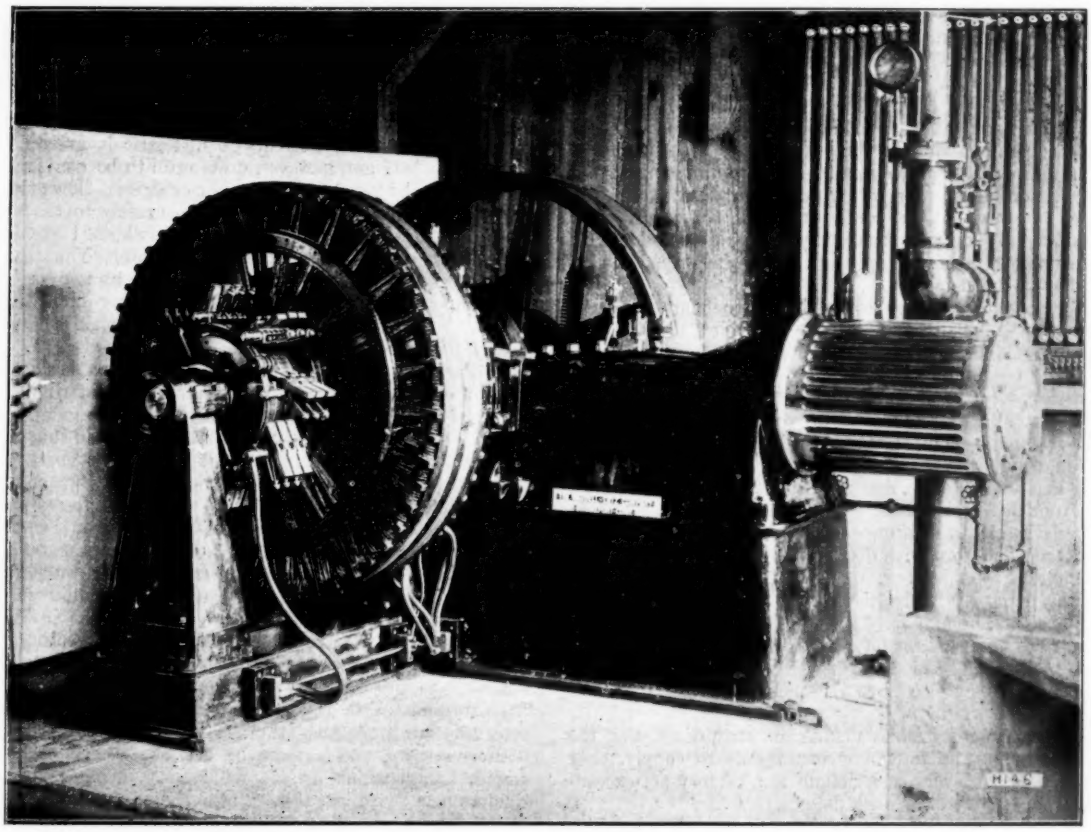


Fig. 5.

Fig. 3.

From the description it is plain that the magnetic circuit is from a pole of one spider through the armature to the adjacent pole on the other spider. The sections are not cross-connected, but there are as many brushes as poles, following the practice that has grown up since the introduction of carbon brushes.

Among the mechanical advantages of this dynamo are its great compactness and the manner in which the parts liable to injury are shielded. The field coil is entirely inclosed; when desirable the armature is covered with a brass shield, and the motors are generally thus supplied.

Owing to the symmetrical form of the machine, as well as to the manner in which it may be protected from injury, it is peculiarly adapted as a motor for connection to machine tools and special uses; one of the many applications is to a rotary pump, where it is very effective. Owing to the slow speed the dynamo is largely used in direct connection with an engine, the armature being fitted on the engine shaft, replacing one of the fly-wheels; the compactness and form of the field give the combination a mechanical appearance.

The following table gives the speed and number of poles of the different sizes of dynamos :—

Kilowatts ...	2	3½	5	8	12	20	30	50	80
Number of poles	4	4	4	4	6	6	8	8	10
Revs. per minute	900	9,000	750	650	550	410	310	275	220

The external armature in dynamos seems to have some attractions for designers among the largest plants in the world. Some of them are to be found doing good work, principally made by Messrs. Siemens & Halske.

In the Waddell-Entz machine the field magnet differs from those of Siemens & Halske, but resembles Brown's Oerlikon dynamo in construction, having only one coil for a multipolar field.

Fig. 4 shows how the machine is adapted as a motor generator. The construction is quite obvious and seems to us a good combination.

This design also lends itself readily to direct coupling to the engine, as the large armature forms an excellent fly-wheel and produces a symmetrical appearance. This combination is shown in fig. 5.

Livet Refuse Destructor.—According to last Friday's *Globe*, the Livet furnace, about which we had so much to say recently, and in connection with which a company was registered and public subscriptions invited, is still under trial at Halifax.

GOVERNMENT INSPECTION OF ELECTRIC LIGHT AND METERS IN CANADA.

The Canadian Parliament has recently passed an Act providing for the inspection of electricity meters and the regulation of electric light contractors. The following is a summary of its most important provisions:—

The commercial unit of supply of electrical energy shall be 1,000 watt hours, or the equivalent thereof in ampère-hours.

Before supplying electrical energy for illuminating purposes to any purchaser, the contractors shall declare the pressure at which they propose to supply energy at his terminals from the service lines. The variation of pressure at the terminals shall not exceed 3 per cent. from the declared pressure, but the contractors shall not be liable for any variation of pressure caused by unavoidable accident to the generating plant or apparatus, or by the uncontrollable condition of the elements.

The contractors shall be responsible for the maintenance in a safe and fit condition of all electric lines, fittings, and apparatus, belonging to them or under their control upon the purchaser's premises.

If the contractors are reasonably satisfied, by testing or otherwise, that a ground exists on some part of the system not belonging to them, they may inspect the wires and fittings on a purchaser's premises at all reasonable times, after giving one hour's notice, and may disconnect the purchaser's wires from the service lines. If on such testing a ground be discovered having a resistance not exceeding 5,000 ohms, the contractors shall forthwith discontinue the supply of energy to the purchaser's premises.

If any purchaser is dissatisfied with the action or tests of the contractors, he may have his wires and fittings tested by an electric light inspector on application to the Department of Inland Revenue, which has charge of the inspection under the Act. He may also have the pressure at his terminals tested on application.

If the contractors make default in complying with the requirements of the foregoing sections as to supply, they shall be liable for every such default to a penalty not exceeding $20 for every day of such default.

Any person who maliciously or fraudulently abstracts, causes to be wasted or diverted, consumes, or uses any electricity, shall be deemed guilty of theft and punishable accordingly.

Any officer duly appointed by the contractors may, at all reasonable times, enter any premises to which electricity is or has been supplied, to inspect their wires, apparatus, &c.

The amount of electrical energy supplied to any purchaser for lighting purposes, or the electrical quantity thereof, shall, if the purchaser so desires, be ascertained by a meter.

Meters must have direct-reading dials. Electrolytic meters now in use may be continued, but renewals shall be made by the substitution of the direct-reading types.

Meters shall be stamped and verified by inspectors, but no meter shall be stamped which is found to register quantities varying from the legal standard unit of electricity more than 3 per cent. in favour of either the contractor or the purchaser.

Meters shall be verified and stamped once every five years. The contractor shall keep the meter in good repair and shall be responsible for the due inspection thereof, and shall pay the fee chargeable for the inspection.

Further provisions relate to the appointment of inspectors, the imposition of fees, granting of certificates, registration of electric light contractors, penalties for tampering with meters and for violation of requirements of the Act, &c.

As soon as standards and apparatus have been obtained and approved, the Governor in Council may issue a proclamation fixing a day within six months upon which the Act is to go into operation.

The Governor in Council may establish rules and regulations for testing the illuminating power of electric lamps, for instituting tests to determine what style or make of meter shall be used, and such other regulations not inconsistent with the Act, as are necessary for giving effect to its provisions.

CORRESPONDENCE.

The Action of Alternating Currents on Dielectrics, and a Note on Electric Shocks.

I observe that you have made this very short communication in your issue of 14th inst. the subject of your leading article in last week's number.

One slight correction I would like to make in what you say. You refer to my "views." I think if you will turn to my note, you will see that I had no "views" on the subject; I simply stated that "so far as I am aware, there is no experimental evidence at present to show that the influence of equivalent alternating currents on dielectric is greater than continuous." I am, however, quite open to be convinced to the contrary by reasonable and clear evidence. The evidence in your first article did not seem to me exactly to the point, or seemed capable of other explanation, which I gave, and which you do not altogether seem to dispute. You then go into the matter somewhat further, and take up two or three points upon which I should like to offer a few observations, with a view to elucidate further, if possible, what is certainly a very obscure subject.

In the first place you speak of another action besides disruption of electric currents in dielectrics, and attribute to it the chief *rôle* in destroying the insulation of underground cables. It is quite true that I did not mention this in my note, which was not in any way intended to cover the subject, but if you will turn to the article in your own columns, written in the winter of 1887-8, to which I referred in my note, you will see that then I treated this part of the subject pretty fully, and gave the results of some experiments. The gist of what I said was this: The majority of insulators are more or less hygroscopic; often, too, they contain sulphur in their composition. We know also that the surface of ebonite in testing instruments is far more conducting than the substance of the material itself. Again, it is known that brush discharges in the air generate ozone, which is a powerful oxidiser. With these various tendencies, therefore, as soon as a flaw in the insulation of a cable develops, deleterious actions set up, and a more or less conductive surface is found, across which an arc will spring, even if the conductors are twice to three times the distance which the electric pressure would enable an arc to be set up in air, and, of course, many more times the distance through which a disruptive discharge would penetrate the insulation itself.

While bringing forward this argument, however, I do not actually know of anything to prove that this effect occurs more with an alternating than continuous current, though it is conceivable with continuous currents the effect would be greater if the current was flowing in such a direction that the liberation of ozone occurred near the outside of the cable, when it would meet with fresh supplies of oxygen, than if it took place on the inner surface of the insulation to which oxygen, even where there was a slight abrasion, would penetrate with difficulty.

The evidence you relate as to the behaviour of a certain dielectric, the nature of which you do not mention, is very interesting. Is it not worth giving full particulars, if they have not already been published, as this is precisely the evidence which is desirable, and which, it seems to me, must almost certainly come from cable manufacturers who have opportunities of putting different materials to long comparative tests at even temperatures, a thing which it is almost impossible to do, even in the best equipped central station; besides which, it needs the special skill which only the constant practice of testing in a factory or analogous place can give. It is true that, under the *régime* of Mr. T. Fletcher, I had such opportunities in the United Telephone Company for two years, commencing about ten years ago, of which I availed myself to some extent at the Grosvenor Gallery afterwards; but since my more intimate connection with electric lighting and power distribution, I have found these matters much in the background; in fact, as regards cables for electric lighting, we are still a good deal in the dark ages. The subject will be serious enough in a few years, when cables now laid begin to give out; but until then it is hardly likely that very much attention will be devoted to a subject which, however important in itself, is less immediately so than many other problems which now face the electrical engineer.

To change the subject slightly, I notice you are giving prominence to the question of the resuscitation of people who have experienced severe shocks. I do not want to be egotistical, but if you will kindly refer to my article in your paper, written in November or December, 1887, you will find the views you now give prominence to quite clearly set forth.

I was so convinced of the truth of the matter when I had charge of the outside work at the Grosvenor Gallery in 1887, that I intended to have had rules of the kind alluded to by Mr. Kolle—who afterwards took up my work there—printed, and I actually proposed to Mr. Ferranti and the directors that the men should be called together and the subject explained to them from this point of view, that they might render aid to each other in case of need. The course I suggested was, however, not approved of, and as it was not considered desirable that any one whose ideas did not lead him to be hopeful over the prospects of Deptford should hold a high executive office, my connection with the company and Mr. Ferranti was shortly afterwards severed.

G. L. Addenbrooke.

Professional Etiquette.

Your article on "Professional Etiquette" of this date is very good indeed. We quite agree with you, but there is something more behind it than you may, perhaps, imagine. Some two years ago we felt that all curative articles that possessed real merit should be sold through medical men only, and that advertising the articles was degrading. With that view we called upon a most eminent medical man, an official of the Royal College of Physicians, and proposed to him that, if he would place a proposition before that Society, to try and have an Act passed by Parliament, that all curative articles, patent medicines, electrical appliances, &c., should be under license from Government, and that we would do all in our power to assist. We also suggested that there should be a board of capable officials, both medical and electrical, to examine the articles, and only when they contained the merits claimed should a license be issued, and allowed to be advertised in professional organs, and sold only to medical men, or by their prescriptions. He would not, however, much to our surprise, entertain it. He acknowledged that he knew our appliances to be all we claimed for them, but remarked, "if we depended on medical men we could starve," but advised us to go on advertising. We were astonished at the result of our endeavours.

Under such circumstances it is no wonder that the press is filled with the most objectionable advertisements such as you mention. We believe that our idea of a Government license is the only remedy.

J. L. Pulvermacher & Co.

September 21st.

The Money & Nash Arc Lamp.

We think your remarks with regard to the variation of volts across the terminals of an ordinary arc lamp, as compared with our 2-carbon lamp, need a little consideration.

You state 1 volt is allowed for a 6-ampère lamp burning one pair of carbons only.

If you place a voltmeter across the terminals of our lamp when feeding, the variation is only 2 volts, and as there are *two arcs in series*, we think you will agree with us, the regulation of this lamp fulfils the desired requirements. Trusting you will find space for this in your columns,

Money & Nash.

September 22nd, 1894.

Portable Batteries: Patent Law "Protection."

In reply to your correspondent, "M. H. G.," I cannot, unconditionally, put him in the way of obtaining *full* information as to the *batteries* which I referred to in my letter, because these (which, by the way, are secondary, not *primary* batteries) are not fully patented, but only "provisionally protected." That is to say (for it is necessary to explain the Patent Office notion of protection), anyone obtaining such full information would be at perfect liberty, for the next six or eight months at least, to work, manufacture, advertise, and vend the invention, in the capacity of "sole manufacturer" (and afterwards to bring out a so-called improvement upon it), to the detriment of some studious and hard-working simpleton who may happen to be the inventor. *Experto crede!*

But I am far from supposing that "M. H. G." would take an unfair advantage of any information he may obtain confidentially; and therefore—if the editor, in the exercise of his discretion, will slightly strain a point of journalistic etiquette—I shall be happy to communicate personally with the gentleman to whom the above initials belong, and to endeavour to aid him in finding what he requires.

Desmond G. Fitzgerald.

The Design of Small Dynamos.

I ask your advice about a shunt-wound dynamo (own make). I enclose a sketch of the cast-iron field magnet and shuttle armature. There are three coils on each core of magnet, and each coil contains 150 turns of No. 22 cotton-covered wire. The six coils are connected in series for a shunt machine, and weigh about 3 lbs. I have tried two armatures, the first, drum, composed of sheet iron discs, $2\frac{1}{8}$ inches diameter. It is 4 inches long, same as length of tunnel of field magnet. On this armature there are 16 coils, of five turns per coil, No. 18 double C.C. wire. The connections are made as if it was one continuous coil with commutator connections at 16 different places. The second is a shuttle armature, cast-iron, wound with about 33 yards No. 18 D.C.C. wire, and a two-part commutator. I used a 6-cell (half pint) bichromate battery to magnetise fields, but could not get the least current with the drum-wound armature. With shuttle armature a half-dozen sharp turns of pulley rang an electric bell. I got similar results with this armature when battery was connected to one coil on each core, and the other coils connected in shunt with machine, but not in any case could I get current when battery was disconnected from field coils. I expected to drive three or four 8-C.P. lamps at 20—25 volts, 6 ampères for 2,500 revolutions per minute. Would you kindly explain errors, or advise me how to go ahead? Thanking you in anticipation,

A. W. Johnston.

September 22nd, 1894.

[There is a limit in dimensions of dynamos, below which they cannot possibly act as self-exciting machines, and our correspondent seems to have hit it a little below the limit. Still, with a soft iron laminated shuttle wound armature, the machine might possibly work with the field in series and a low external resistance, or it would do for a motor, but is too small for any use as a dynamo; the shuttle core is only $\frac{3}{4}$ inch, while the field core is $2\frac{1}{4}$ inches. They should be nearly equal, as they are of same material, C.I., and carry the same flux.—Eds. Elec. Rev.]

The Velvo Carbon Primary Battery.

The editorial notices referring to my battery published in your issue of yesterday, raise a number of questions concerning which some few words from myself may be acceptable.

In the first place, I may state that I consider that *no* depolariser battery, more particularly one employing a secret solution, comes into competition with mine in any way *whatever;* at the same time, while not making these batteries ourselves, we can, we believe, supply the manufacturers of them with better and cheaper negative electrodes, provided with cheaper and more permanent connections, than they can elsewhere obtain.

I would call attention to the great difference in the curves of discharge of my battery, and the experiments of Sprague with the Smee cell which you have quoted. I should be glad if you could reproduce the curves of discharge, copies of which I furnished your representative with.

In reference to your notice stating that it is not claimed for my battery that it is efficient, I may disagree with you, for we in all cases approach very near to the theoretical ampère-hours obtainable from the quantity of zinc consumed. For a specified number of watt-hours we use less zinc than

any single fluid depolariser battery; of course, we use more zinc per watt-hour output than a double fluid cell, but if absolute efficiency is considered, we certainly get more watt-hours per unit cost than a double fluid cell employing nitrate of soda solution, which is the cheapest depolariser.

The working potential difference at the terminals of my battery when giving a heavy current is from ·5 to ·65 volt per cell, according to the current density. There are very few depolariser batteries which give a potential difference of anything appreciably more than 1 volt per cell when delivering their full current.

You stated the cost of zinc at 5d. per lb., and the cost of acid at ½d., omitting consideration of the points which I drew attention to in my postscript, namely, that zinc being now about 20s. per cwt., where this can be dealt with by the user of the battery, the cost of working may be very materially reduced. In some cases, especially with the lighting type of cell, it may be under 1s. 6d. per B.T.U.

Now as to other sulphuric acid batteries, I should first explain that the invention of this negative electrode of mine sprang out of the necessity for it which I found to exist when I took up experiments with the existing forms of cell with the view of deciding which principle of construction to adopt in the battery for my little launch then building (this launch has been in frequent use since early in 1893, at Maidenhead, Windsor and Richmond). The difficulties I experienced were—

A. In the Smee form of cell.

1. The need of re-platinising the silver electrode.
2. The considerable cost of the same.
3. Its corrosion on the water line.
4. Its polarisation and ultimate destruction by amalgamation.
5. The inconvenient, dirty clamp and wire connections.
6. The difficulty of replacing used zincs.

B. In the Walker form of cell—

1. The need of replatinising the carbon.
2. The connections (worse than the Smee).
3. The polarisation of the negative electrode consequent upon the reduction of metallic mercury on its surface.
4. The difficulty of renewing the zincs.

In the case of the latter form of cell I succeeded, after many experiments, in fixing the platinum by my patent inplatinisation process. In this instance I employed the chloride of that metal as a constituent of the carbon glaze, which was applied to the plates before the final firing. Under this process the metal exists in a very divided state, and is held intimately in contact by the fine glaze. This, however, did not overcome the mercury polarisation which was discovered subsequently.

The type of cell which has now evolved under my hands after some years of close experimental work is cheap, permanent, clean and handy to a degree, as is readily conceded by all who have seen the handling of the large battery of my 35-feet launch. There is nothing in connection with the work of this 600 ampère-hour battery which I should be afraid to trust to a gardener, and my E.P.S. experience of gardeners in charge of batteries is fairly extensive.

I claim that I have overcome the difficulties experienced in other types of sulphuric acid batteries, and I claim for sulphuric acid batteries generally that they are the lightest and cheapest for any given output.

Regarding the chromic tests with long pile carbons, these were only made to find the time it took to reduce the entangled solution. In chromic solutions the Velvo carbons, after the reduction of the entangled liquid, are but little better than plain carbons. In nitrate of soda solution, however, where liberation of gas takes place, the result is altogether in favour of the Velvo carbons, as might be expected. I am making some proper tests of electrodes in this solution (which I believe is used for the Weymersch battery), and will communicate them to you at the earliest opportunity.

Friends who wish to do so, can readily compare the figures and curves given in my report pamphlet with those obtained under their own experience with other batteries.

We should be pleased to send this pamphlet to anyone on application, and we should also be indebted to any person who, taking a sufficient interest in the matter, would make any tests he might deem desirable at our works. We should be pleased to lend him such measuring instruments as we have, or he might bring his own.

The invention of the Velvo carbon negative electrode itself dates from nearly two years back. I should be pleased to give any further information that may be desired. We have no secrets, and all the processes are well covered by patents.

The Battery and Motor Company,
H. T. BARNETT, *per* F. C. B., *Manager.*
September 22nd, 1894.

[We did not compare the Velvo battery with any depolariser battery, nor considered that it would come into competition therewith.

We expressed an opinion that a test between the Velvo and a Smee and Walker battery would settle the question as to the extent of the improvements in Velvo carbon, and if the curves showing Mr. Barnett's results of his tests had been verified by Prof. Jamieson, or other independent expert, we would have published them; if they also had been accompanied by curves from Smee and Walker cells of same weight and surface exposed of zinc, they would have had some value.

We know of many two fluid cells which can be relied upon to give at least 1·8 volt at full current, so that Mr. Barnett must have arrived at his 1 volt for these cells by some very poor specimens being tested.

Ampère output is not a measure of efficiency. The only measure of efficiency is $= \frac{\text{total watt hours}}{\text{lbs. zinc}}$.

We must take the price of zinc at which it can be bought in the usual way anywhere, and 5d. per pound is a fair average price for good rolled sheet. And we might have added something for mercury, which is not recoverable, and moreover is not cheap, and is required in some quantity for amalgamation.

The lighting type of cell may give a B.T.U. for 1s. 6d., but nothing short of actual demonstration would convince us of the correctness of this estimate.

Weymersch solution is not nitrate of soda; it can be had from the Weymersch Battery Company Syndicate. It would be unfair to give tests on nitrate of soda for Weymersch solution tests.

Our suggestion to test the Velvo against the two batteries of the same class, if adopted, would prove more than pages of claims and assertions by the inventor.—EDS. ELEC. REV.]

CHELSEA ELECTRIC LIGHTING.

THE surveyor's annual report for the year 1893-94, contains the following references to electric lighting matters in the Chelsea district:

"The number of houses in Chelsea lighted by electricity by the various companies for the last three years was as follows:—

	1891-2.	1892-3.	1893-4.
Chelsea Electricity Supply Company ...	312	390	500
Cadogan Electric Light Company ...	18	—	—
London Electric Supply Corporation ...	2 (?)	—	6

"It will thus be seen that the Chelsea Electricity Supply Company have maintained a steady progress, and appear to be giving satisfaction to their customers.

"*Meter Testing.*—Under the Chelsea Electricity Supply Company's order, the Vestry, who are the electrical authority, are authorised to examine and test meters. Only one application was made during the past year to have a meter tested, which was from 59, Cadogan Square. Mr. Morgan Williams, A.M.I.C E., tested it on behalf of the Vestry, and found that at the average load it registered 8·27 per cent. too low. The Supply Company on receiving this intimation fixed a new meter in place of the defective one.

"To avoid delay in the testing of meters the Vestry authorised me to make arrangements to have electric light meters tested immediately an application is received.

"*Extensions of Electric Mains.*—The Chelsea Electricity Supply Company made application in April to lay mains in Redesdale Street, Tedworth Square, Christchurch Street, Oakley Street, Chelsea Embankment, Manresa Road, Elm Park Estate, and other streets in these neighbourhoods; and in December to lay mains in Wellington Square.

"The London Electric Supply Corporation gave notice of their intention to lay mains in Sloane Square and King's Road, as far as Smith Street, in May, but in October they subsequently extended as far as Flood Street.

"*St. Luke's Electric Lighting Order*, 1891.—On June 9th the Board of Trade officially notified that they had revoked this order. The circumstances connected with the cancelling were detailed in my last annual report.

"*London Electric Supply Corporation.*—In the early part of October a slight accident, causing more alarm than damage, occurred on this company's circuit, namely, the blowing off the cover of a pavement

box in Sloane Square. Major Cardew, on behalf of the Board of Trade, reported upon the accident, and recommended certain alterations in the circuit, and the insertion of a more sensitive fuse. At the end of the year, however, the requisite alterations had not been carried out to the satisfaction of the Board of Trade.

"*Proposed Electric Lighting Scheme of the Kensington Vestry.*—In November the Kensington Vestry gave notice in the *London Gazette* of their intention to apply to Parliament for power to lay mains for electric lighting from their wharf in Lots Road through certain streets in Chelsea, so as to light a portion of South Kensington, and from their depot in Kensal Road to light a portion of North Kensington. These notices, in my opinion, did not comply with the Electric Lighting Acts, and they were subsequently withdrawn, without Bills being deposited.

Pressure Records.

Chelsea Electricity Supply Company.

"From time to time I have examined the records of pressure kept by the Chelsea Electricity Supply Company. They still maintain a very good average where the records are taken at a pressure point in the mains. The automatic system of regulation adopted appears to be very satisfactory. Self-registering records of pressure are maintained at all the stations and sub-stations belonging to this company.

London Electric Supply Corporation.

"After the explosion in the street box in Sloane Square, the Vestry authorised me to examine the records of the London Electric Supply Corporation. I find that they have one record of pressure kept at Adelphi Terrace, which appears to be the only continuous record kept. The records are not so regular as those of the Chelsea Electricity Supply Company, but as the system of the London Company is, of course, a high pressure system, it is, perhaps, not to be expected that there should be the same regularity as in a smaller, low pressure station.

"In the early part of December, owing to an accident to the machinery at the generating station at Deptford, the supply was cut off for a short time, which was also the case at the end of October, when the fault appeared in the mains at Sloane Square, but otherwise the supply appears to have been constant.

Town Hall Lighting.

"During the year the Vestry had under consideration the adoption of electric light at the Town Hall and Council Chamber. Estimates were submitted by 13 firms, and varied from £225 to £500. I reported upon the four lowest estimates, and finally the Vestry undertook to adopt electricity in the Town Hall, Council Chamber, Large room and corridors. At the end of the year the actual contract had not been entered into.

Overhead Wires.

"The Overhead Wires Act, which was passed in 1891, compelled the owners of overhead wires to furnish the Vestry with a list of their wires within six months after the approval of the County Council's bye-laws. This period of six months expired in January, 1893. From time to time I had written to the National Telephone Company, asking for the particulars, but I was informed that the County Council had extended the period during which notice should be sent to them until January 31st, 1894. The Telephone Company subsequently asked the Vestry to grant them a further extension of time to the end of March. The Vestry, however, declined to do so, and by the middle of March the National Telephone Company submitted a return of their overhead wires. In order to get the whole of the information as to overhead wires, an advertisement was inserted in the local papers, requiring all persons owning overhead wires to comply with the bye-laws before the 1st day of January. Information was subsequently received from Mr. Crasko, Admiral Sir George Willes, the Standard Time Company, and the District Messenger Company.

"Particulars of overhead wires will be found in the appendix to this report."

BUSINESS NOTICES, &c.

Universal Electrical Directory (J. A. Berly's).—Messrs. H. Alabaster, Gatehouse & Co. have now in course of preparation the 1895 edition of this directory, which embraces all connected with the electrical trades throughout the Universe. It is indispensable to all having business transactions in the electrical world. Names and addresses for insertion, corrections, and orders for advertisements should be promptly forwarded.

Aberdare.—Steps are being taken to form a local company for the purpose of carrying out the provisional order already obtained for lighting the town by Messrs. J. C. Howell, Limited. A deputation have visited Pontypool and inspected the installation there.

Aberystwyth.—Last week the dynamos and cables laid down for electric lighting were tested at the works and found to act satisfactorily.

Acton.—The Works Committee report that they have deferred to their next meeting the consideration of two letters from electrical engineers as to the proposed sale of the Board's electric lighting order.

Ashford.—Ashford Hall, the residence of Mr. R. Clifford Smith, is being fitted throughout with the electric light by Messrs. Drake & Gorham. The necessary power will be obtained from a saw-mill at some distance from the house, the plant being so arranged that the charging can be effected at the same time as the saw-mill is in use. There will be 53 D.P. accumulators capable of supplying 240 8-C.P. lamps for four hours. A Nevile automatic switch, for which the firm are sole agents, will be fixed to prevent any reversal of current at times of exceptionally heavy load on the saw.

Ballarat (Australia).—The Ballarat Electric Supply Company, Limited, is starting operations, and proposes to erect a plant value £40,000 for the supply of public and private lamps. A large contract has been handed to them by the Railway Department for the supply of electric light to the Ballarat Station and yards. Professor Threlfall, of Sydney, and Mr. Ellson, of Adelaide, have been appointed joint consulting engineers for the scheme.

Battersea.—The Special Committee appointed by the Battersea Vestry have carefully considered the question of lighting the parish by means of electricity. They are strongly of opinion that it would be inadvisable to allow the powers of the Vestry to pass into the hands of a company, and although they are not at present prepared to recommend the Vestry to take immediate steps to obtain a provisional order for powers to light the parish by electricity, they suggest that the matter should stand over with the understanding that the order be applied for eventually. Companies are to be resisted in the meantime.

Berlin.—The Berlin Electricitätswerke is reducing its charge, as from October 1st next, for a supply of electrical energy for power purposes to 16 pfennigs (about 1·86d.) per 100 watt hours.

Bombay.—Messrs. John Fleming & Co. have just been paid 1,020 rs. in connection with their contract for lighting the Crawford Markets and the Municipal Offices by electricity.

Bowness.—The electric lighting of the streets is done by Messrs. R. H. Fell & Son, Limited. This company threatened the Local Board last week that unless the account to July 31st was paid by 20th inst. proceedings would be commenced against them. Several members considered the lighting had not been altogether satisfactory, and the Lighting Committee in consideration of a record which was kept of the lighting by the surveyor, recommended the Board to withhold payment of £120, one half of the cost of installation, as per the agreement made with the Electric Light Company, at the outset, until all was certified as satisfactory by the surveyor, as well as a reduction of £6 odd for default which had been noticed in the lighting. After considerable discussion, the recommendations of the Lighting Committee were adopted, and it was resolved that a cheque for £102 1s. 9d. be signed, that purporting to be the amount which the Board considered themselves indebted to the Electric Light Company.

Brechin.—Mr. Robert Duke (of Messrs. D. & R. Duke) has made an offer to the town of a supply of electricity to light St. Minian's Square from a dynamo at their works. The town would have to bear the cost of erecting lamps, &c.

Cambridge.—During the vacation, considerable additions have been made to the supply of current for house, shop, church, but chiefly college lighting. Ten colleges are connected, and consume large amounts of energy, whilst in Caius and Sidney the light has been installed throughout in place of gas, including courts, staircases, and rooms. The new Sidgwick Hall of the ladies' college at Newnham is wired throughout, and current will be available by the beginning of the term. Holy Trinity church has adopted the light, and the demand for private house lighting is largely on the increase, a mile of main being laid in the residential district of Newnham. The wiring has been executed chiefly by the local firm of Messrs. Baily, Grundy & Barrett, Limited. Street lighting is in abeyance, beyond a limited amount, the gas company having a contract running for some little time to come. To meet the increased demand, a new Parsons steam turbine alternator is being fixed for the winter months. Substations, equipped by Parsons & Co., are rapidly replacing the house-to-house transformers.

Cardiff.—In view of the early completion of the Corporation electricity works the Lighting and Electrical Committee have issued a pamphlet containing a few particulars for the guidance of intending users of the electric light, and they strongly recommend that the wiring of premises be put in hand at once.

Chelmsford.—The electric arc lighting of the public park last week, on the occasion of a fête, was carried out by Messrs. Crompton & Co., Limited.

Chester.—The Town Council, last week, decided to adopt the Water Tower Gardens, belonging to the Corporation, as the site for the proposed electric generating station. They further empowered the Electric Lighting Committee to proceed to establish the installation, submitting tenders or terms of the proposed contract to the Council in the usual way.

Coventry.—At last week's City Council meeting the minutes of the Electric Lighting Committee read, stated that a letter had been received from Mr. Hammond with respect to the appointment of a clerk of works to superintend the execution of the electrical portion of the contract for the equipment of the central station. The letter has not yet been considered by the committee.

Permission has been granted to the Coventry Gas Fittings, Electrical and Engineering Company, Limited, to supply electric energy for the lighting of the Technical Institute pending the completion of the Corporation supply station, they undertaking to discontinue such supply on the Corporation being in a position to supply the Institute.

Derry.—Another noisy meeting of the Corporation last week discussed the failures in the electric light cables. It was stated that Messrs. Siemens had had a man in the city repairing faulty cables for the past thirteen weeks. There yet remained two circuits to be tested. Of the other two one had several times broken down, and the other on Monday last week broke down with 1,700 volts, when it should have stood 4,000 volts. Messrs. Siemens have, under the contract, to maintain the cables until May next.

Dublin.—The Corporation employés were last week engaged in removing the gas lamps from a number of the thoroughfares.

The South City Markets, which were two years ago destroyed by fire, have been rebuilt, and six electric arc lamps have been introduced.

Dundee.—At a meeting of the Finance Committee of the Gas Commission last Monday, Mr. James Mitchell, the convener, submitted a statement regarding the income for the past six months for the supply of electric light. The receipts for the first quarter last year amounted to £229, while for the same period this year the total was £452—an increase of £223. During the second quarter last year the sum realised was £211, while this year the figures are £384, showing increase of £173. The estimated increase for the whole year is £671, but should the increase for the next six months be at the same rate as it has been for the past half-year, the increase will be about £2,428. Last year the total income was £2,649.

The basement and first flats of the large upholstery premises in North Lindsay Street and Whitehall Street, belonging to Mr. Thomas Justice, are lighted electrically. The Dundee and North of Scotland Institute of Mechanical Engineers recently paid a visit to the works.

Ealing.—The Free Library reading rooms are to be lighted by electricity, the cost being about £44.

Edinburgh.—A deputation of members of the Corporation is to come to London for the purpose of selecting a lamp for the public electric lighting, several specimens having been fitted up in Westminster by the Corporation's consulting engineer.

Fermoy.—The enquiries to which we referred in our last issue have been made regarding the proposed lighting by electricity. Voluminous communications have been received from the town clerks of Bray, Carlow, and Kilkenny *re* the cost of electric lighting in those towns. The board, having discussed the matter, came to the conclusion that putting the cost of public lighting at present, including wages of watchmen, &c., at £150, it would leave a balance of £500 to be derived each year from private consumers. The opinion of the commissioners was that the Gas Company derived at least £2,000 per year from the latter source, and the clerk was directed to ask the engineers of the Kilkenny and Bray Electric Lighting Company on what terms they would come to Fermoy to confer with the commissioners on the subject and prepare an estimate of the cost.

Fulham.—Recently some new decorations have been introduced into the Town Hall and the Town Hall Committee have been instructed to consider immediately the advisability of installing the electric light, as these decorations would be spoiled by gas.

Hampstead.—Messrs. W. Bathurst, O. Hansom, and E. Sayer have been appointed assistant engineers at the electric lighting station at £104 per year; clerks, storekeepers, drivers, engineers, regulators, trimmers, labourers, engine cleaners and wiremen are also being engaged. The following cheques have been drawn for work connected with the station:—Messrs. Yerbury & Sons, twelfth instalment under contract for the erection of the central electric supply station, as per certificate of architect, £500; Messrs. Siemens Bros. & Co., Limited, fourth instalment under contract for supplying and fixing electric lighting plant, as per certificate of engineer, viz., steam dynamos, £962 16s., arc lamps and posts, &c., £110, £1,072 16s. Total, £1,572 16s.

The Vestry, last week, decided to insure the electric light station and plant.

Hove.—The wiring of the Town Hall for electric lighting is nearly completed.

Huddersfield.—A committee was recently appointed to consider the advisability of reducing the price per unit, and of adopting the graduating scale, also of reducing the meter rents. They have now resolved that no reduction be made in the charge per unit, but that discounts ranging from 2½ to 10 per cent. on consumption of 1,000 to 4,000 units and over; also other discounts if the consumption per 8 C.P. lamp exceeds a certain number of units. For motive power and domestic purposes the charge will be 4d. per unit, as from July 1st last; the following revised scale of meter rents has been adopted:—Meter and switch rental (30-watt lamps)—1 to 25 12s. 6d. per annum; 26 to 50, 15s.; 51 to 100, £1; 151 to 200, £1 7s. 6d.; 201 to 300, £2 10s.; 301 to 400, £3; 401 to 500, £3 10s. There is to be an extension to Lindley at an estimated cost of £430; the estimated revenue from this is £100. The mains are also to be extended so that the Armoury may be electrically lighted.

Kidderminster.—A Councillor last week suggested that the Law Committee be requested to bring up a report *re* proposed electric lighting.

Killarney.—Mr. Leake has furnished his report on the proposed electric lighting of the Lunatic Asylum, and it has been decided to accept the tender of the Killarney Electric Light Company, subject to the addition of certain conditions mentioned in Mr. Leake's report, and to ask the Board of Control to affirm such acceptance and apply for the necessary funds for the electric lighting installation.

Kingswood.—In the words of the Chairman of the Local Board they may "at a future date extend the electric lighting area," and, judging by other remarks, that date would appear to be not far off. No extensions have been carried out for 18 months.

Leicester.—The engineer to the gas department having stated that electricity "cannot be produced at a profit on a retail scale at a lower cost than 6d. per unit," a correspondent of the *Leicester Post* has taken up the cudgels on behalf of the electrical fraternity and disproves the statement. He goes into figures and brings out the cost at less than 2d. per unit, but in making his calculations he has left out important items. However, we would draw the engineer's attention to the fact that at Bradford, Manchester, St. Pancras, Newcastle and Newcastle-on-Tyne, the average price obtained per unit is under 6d. and a profit is yielded. At Derby, and other towns, also the charge is 6d. per unit.

Lymington.—Some members recently enquired into the lighting question and came to the decision that electric lighting will not be suitable for the town.

Madras.—The first 50 cars intended for the Madras Electric Tramways Company, Limited, have been fitted up at the Perambore Railway workshops, and will be made over to the tramway authorities in the course of a few days. The *Times of India* says the cars are 24 feet long and 8 feet broad, and have compartments for first, second and third class passengers.

An Indian engineering contemporary states that the Madras Government has conferred a boon upon the public by according sanction to a revised estimate, amounting to Rs.18,000, for lighting the Arconum Station with electricity. This amount includes the cost of apparatus, house, &c.

Merthyr.—A lad was fined here last Monday for damaging telegraph insulators by throwing stones at them.

Moss Side.—A report has been presented to the School Board showing the comparative cost of lighting the Board's new schools by gas and by electricity. A full meeting is to discuss the matter.

Newport.—The question of electric lighting the Free Library is in the hands of a sub-committee. The estimated annual cost of the lighting is £101 7s.

Nottingham.—St. Paul's Church, which was lately reopened, has been lighted by electricity.

Paris.—The receipts of the Paris Edison Company continue to increase. The receipts for August, 1894, amounted to 157,660 francs, whereas in August, 1893, they amounted to 135,493 francs. This year, therefore, shows an increase of 22,167 francs. From January 1st to August 31st, the total receipts were 1,795,747 francs in 1894, and 1,745,115 francs in 1893. Thus the increase during 1894 is 50,632 francs.

Penzance.—The electric light has been installed in the premises of Mr. W. T. L. Perry in Parade Street. The motive power is supplied by an engine used in his fish-curing business. The installation was carried out by Mr. V. Corin.

Poplar.—The Board of Works has decided to circularise residents in the district, enquiring whether they will take the electric light, if introduced by the Board, at 6d. per unit for lighting, and 4d. per unit for motive power purposes.

Plymouth.—The Gas Company have just completed a most extensive addition to their works and plant.

The two men who were charged last week with stealing telegraph materials, the property of the Postmaster-General, have been committed for trial.

Rhuddlan.—It has been suggested to light this town with the electric light, the motive power to be obtained from the Dyserth waterfall. Some experiments have it appears been carried out here of late, but the *Rhyll Journal* refers to them in language so steeped in mysticism that we cannot tell whether it was gas, oil, or electricity that was used. There is a lengthy epistle regarding the experiments, very little of which we can comprehend, but doubtless that is our fault only; Rhuddlan inhabitants are perhaps used to the country reporter's gushing style.

Shoreditch.—The Vestry last week, by a majority of seven votes, deferred for six months the appointment of an electrical engineer. This is considered by some a defeat of the parties anxious for the combined scheme of electric light, dust destruction, and baths. The December elections are looked forward to by others as likely to be influenced by this scheme, to which many of the ratepayers are bitterly opposed on account of their already being highly rated.

Southport.—The Town Council have decided to lay a low tension main down on the promenade from Bold Street to Seabank Road, along Seabank Road and in Lord Street from Seabank Road to Bold Street. The proprietors of the Queen's Hotel have applied for a supply of current, and it is probable the convalescent home will also want a supply, and then it will be easy to run the cable along the course mentioned above.

Southsea.—Messrs. Bowerman Bros. have lately fitted up an installation of the electric light at the residence of Capt. Bradley, R.N., in Southsea.

Stirling.—About six months ago the Town Council decided by a majority of two that they would not oppose the application of a local electric lighting company for a provisional order. They were brought to this decision by the intervention of the Board of Trade. Things, however, seem to go rather strangely and uncertainly at Stirling, for the Council have now decided to proceed with an application for an order to carry out the work themselves, this time only two voted against the resolution for which there were only two in favour formerly.

Sunderland.—Messrs. J. H. Holmes & Co., are engaged putting down an electric lighting installation at the works of Messrs. George Clark, Limited, Sunderland. The installation consists of two "Castle" dynamos, to be driven by gas engines of 40 I.H.P. each, and to supply 45 arc lamps, each of which will have an illuminating power equal to 2,000 candles. The work is now nearly completed.

The Town Hall is be lighted by electricity in the manner proposed in the report and estimates of Mr. C. S. V. Brown, the borough electrical engineer.

Swansea.—It was last week stated at the Town Council's meeting that preliminary steps are being taken towards getting the town lit by electricity.

Todmorden.—The Millsteads and Cinderhill Mills of Messrs. Bancroft & Co. are being lighted electrically. The necessary work is being laid down under the superintendence of Messrs. Baxendale & Co.

Walthamstow.—A special meeting of the Local Board is to be held to consider the desirability of applying for a provisional order for electric lighting. Gas in the district is 4s. 6d. per 1,000 cubic feet.

The Indestructible Ignition Tube Syndicate, Limited, have just completed an arc light job in Walthamstow at Messrs. Everett's stores. There are 16 arc lamps and 16 incandescent lamps.

Wells.—The Town Council have referred the question of electric lighting to the Lighting Committee for consideration and report.

Wolverhampton.—A correspondent of one of the local papers calls attention to the obstructive way in which the new electric lamp-posts are being erected; he considers they seriously affect traffic. He saw a railway waggon collide with one of the posts last week; should this often happens doubtless the lamps will be more seriously affected than the traffic, for if kicking the lamp-posts at Bath caused so much inconvenience, hard blows from such waggons as this must do far greater damage. But the correspondent to whom we refer, in concluding his letter, makes that suggestion which has been put forward by several others who have not sufficiently considered the matter. He recommends that posts be abolished and brackets attached to the houses in lieu thereof. As we have before explained, such a suggestion is impracticable in all but narrow thoroughfares, even were it desirable.

Agency.—Mr. G. Straus, of 130, Queen Victoria Street, E.C., has been appointed sole agent for Great Britain for the Elektricitats-Gesellschaft Gelnhausen, Limited, who make a speciality of accumulators. That company are now said to be in a position to turn out accumulators under a new patented process, by which they claim to be able to reduce the weight about one half, besides possessing several other advantages. The accumulators have been successfully employed for lighting railway trains in Germany.

Bankruptcy.—The creditors of Wm. David Gooch, electrical engineer, late of 3, Victoria Mansions, Westminster, met last Monday at the London Bankruptcy Court. The debtor has not yet filed a statement of his affairs, but he roughly estimates his liabilities at £3,900, and the only asset returned is one-third interest in a patent for automatic distribution of liquids, to which no present value is attached. In the absence of any offer, the case was left in the hands of the Official Receiver to be wound up in bankruptcy. The debtor ascribes his failure to losses in connection with speculative electrical patents in which he was interested.

Cochrane v. The Exchange Telegraph Company.—Before the Lord Chief Justice in the Chancery Division on Wednesday, application was made for leave to serve notice of motion for next Wednesday in this action, and for an interim injunction restraining the defendant company, in the meantime, from disconnecting a tape telegraph instrument on his premises, and from ceasing to supply him with the market price of stocks. The defendants, under a licence from the Postmaster-General, had a monopoly of supplying subscribers with that information by tape machines, and they had entered into a contract with the plaintiff under which the instrument was placed in his offices, but had discontinued the service in consequence of a resolution of the Stock Exchange Committee, every such contract being subject to the rules and regulations of the Stock Exchange.—The Lord Chief Justice gave leave to serve the notice of motion, but refused to grant the interim injunction.

D.P. Batteries.—Messrs. Drake & Gorham inform us that accumulators of this type have been supplied to one contractor amounting to nearly 30,000 plates, and not one single plate has ever failed. The first cells put in are stated to appear after five years' hard work to be in every way as good as new.

Government Buildings.—The work of laying on the electric light in the Houses of Parliament, which has been continued during the vacation, progresses slowly. An evening contemporary says that it is not likely to be nearly completed by the beginning of next Session.

During the recess the electric light is also being introduced into the Government Offices in Downing Street. Special fittings have been designed and manufactured by Roger Dawson, Limited, for Lord Rosebery's room, the Reception Room, and that of the Cabinet Ministers.

Green's Economiser.—We learn from the recently published list of awards granted at the Antwerp Exhibition, that the well-known firm of fuel economiser makers, Messrs. E. Green and Son, of Manchester and Wakefield, have gained the diploma of honour (highest award) for their improved patent fuel economiser. The fact of this apparatus having already gained 16 prize medals and awards is sufficient evidence that the inventors and patentees have so perfected their speciality as to make it thoroughly up to the requirements of the present time.

Leslie v. Rogers.—Before Mr. Commissioner Kerr last Monday, Mr. William Hicks, solicitor, appeared for the plaintiff, the receiver of Woodhouse & Rawson, Limited, Queen Victoria Street, who sought to recover the sum of £12 18s. 6d. for goods supplied to the defendants, Messrs. Arthur and J. W. Rogers, trading as the Mechanical Engineering Company, of Saffron Hill. Mr. Turner was the defendants' solicitor. The defendants disputed some of the items of the account, because some of the goods were ordered by their manager for himself. In the end the Court found for the plaintiff for the sum of £9 12s. 8d.

New Issue.—Mr. W. Perren Maycock's "Elementary Manual of Electric Lighting and Power Distribution" is on the eve of issue in one vol. Messrs. Whittaker & Co., 2, White Hart Street, Paternoster Square, are the publishers.

Price Lists.—Messrs. Johnson & Phillips have published a price list dated June, 1894, dealing with the electric cables and wires manufactured by them. All kinds of India-rubber insulation, impregnated fibre and oil-insulated mains, lead-covered and armoured cables, telegraph and multiple telephone cables, and grapnel ropes; also cotton covered copper wires and strips for dynamo winding, flexible cords, and silk covered wires are among this firm's manufactures. This list deals specially with vulcanised cables and wires of various classes. Prices, weights per statute mile, and code words, are given for each sort and size of cable. High conductivity copper and German silver wires, flexible cords for incandescent lighting, and oil insulated cables, are also similarly tabulated. The list is very nicely set out and printed. Messrs. Johnson & Phillips stock a large quantity of all sizes of house-wiring cables.

From Messrs. W. H. Willcox & Co. we have received an illustrated price list of their "Safety" automatic double-feed crank pin lubricator.

The Pneumatic Tyre Company, Limited, have forwarded us a nicely prepared catalogue, illustrative of the adaptation of Dunlop pneumatic tyres to general road conveyances.

Ship Lighting.—The steamer *Copeland*, recently launched by Messrs. W. B. Thompson & Co., Limited, at Dundee, is lighted throughout by electricity, the installation being fitted up by Messrs. Wm. Harvie & Co., of Glasgow. Altogether there are 212 lamps on board, and these are supplied by a 25-H.P. "Glasgow" dynamo. The side lights are also electrical.

CONTRACTS OPEN AND CLOSED.

OPEN.

China.—Tenders have just been invited, according to the last mail, by the Municipal Council of Shanghai, for the erection of buildings for a new central electric lighting station.

Hampstead.—The Vestry have decided to advertise for the supply of coal to the electric supply station for 12 months.

Stroud.—October 2nd. For supplying, fixing, and maintaining fire-calls and telephones for the volunteer and Local Board fire brigades, for the Local Board, in accordance with the surveyor's specification, which may be inspected at his office.

London, W.—October 8th. For the supply of stores from November 1st, 1894, to October 31st, 1895, for the Great Western Railway Company. The following are some of the items:—(9) acids, alkalies, &c.; (10) oils, turpentine, &c.; (17) India-rubber goods; (18) telegraph instruments; (19) telegraph apparatus; (20) copper wire, G.P. wire, &c.; (21) telegraph ironwork and tools; (22) telegraph drysalteries; (23) carbons for electric light; (24) tin, zinc, antimony, copper pipes, brass, &c.; (25) tin-plates; (26) tinware and lamp work; (27) wire, iron, and steel; (28) iron rivets, bolts and nuts, &c.; (29) nails, screws, &c.; (30) chain; (40) tubes, iron and steel; (47) telegraph poles and yellow pine; (48 and 49) horse harness fittings. Samples and patterns may be seen on and after 24th inst. at the office of the Stores Superintendent, Paddington Station. Specifications, with forms of tender, may be obtained at the office of the Stores Superintendent at Swindon or Paddington Stations.

Manchester.—October 8th. For the supply of stores during 12 months ending October 31st, 1895, for the Lancashire and Yorkshire Railway Company. The following are some of the items:

—(13) copper; (16) fog signals; (18) India-rubber; (19) iron and steel, sheets, &c.; (20) iron castings, hydraulic pipes; (21) iron castings, water-pipes; (30) steel and files; (32) sundry tools. Further particulars and forms of tender may be obtained on application at the Stores Department, Osborne Street, Manchester, where parties can examine the samples before tendering.

Chester.—Tenders for the electric lighting scheme will be wanted shortly by the Council.

CLOSED.

Glasgow.—A large order for armoured and unarmoured electric light mains has been placed with Henley's Telegraph Works Company by the Corporation, for the extension of their city lighting.

Hampstead.—The Vestry have accepted the following tenders:—

Messrs. Radford & Co., for the preliminary supply of 50 tons of best Welsh smokeless slack coal at the electric lighting station.

Messrs. Burford & Son, amounting to £57 15s., for fitting up the offices, stores, &c.

Messrs. Maple & Co., amounting to £64 19s. 10d., for supplying the furniture for the offices.

Messrs. Yerbury & Sons, amounting to £38, for providing an iron hurdle fence with gates at the entrance to the electric lighting station, for providing five electric bells, and for cutting through wall and erecting a new gate on the public footpath adjoining, in accordance with the plan prepared by the engineer, and to his satisfaction.

Huddersfield.—Three thousand yards of 7/16 cable has been ordered from Messrs. Calvert & Co., of Folly Hall, by the electric lighting committee.

Cardiff.—The tender of Messrs. Fergusson & Co., has been accepted for installing the electric light at the Town Hall and Market Buildings, at £523 10s.

Hull.—The work of installing the electric light in the General Post Office has been placed in the hands of Mr. Geo. B. Blanchard, Whitefriargate.

BOOKS RECEIVED.

Text-Book of Dynamics. By Wm. Briggs and G. H. Bryan. Published at 2s. by the University Correspondence College Press, 13, Bookseller's Row, Strand.

Text-Book of Statics. By Wm. Briggs and G. H. Bryan. Published at 1s. 6d. by the University Correspondence College Press, as above.

Electric Light and Power, giving the result of practical experience in central station work. By Arthur F. Guy, A.M.I.E.E. Published at 5s. by Briggs & Co., Salisbury Court, E.C.

Durham College of Science (Newcastle-on-Tyne) Calendar for 1894-5 *Session.* Published in London by Whittaker & Co., 2, White Hart Street, E.C.

NOTES.

Society of Engineers.—At the Town Hall, Westminster, on Monday next, a paper will be read on "The Utilisation of Town Refuse for Generating Steam," by Mr. T. W. Baker, B.A.

Feats of Journalism.—It is occasionally very amusing to notice the course taken by information after it has once appeared in the columns of the Electrical Review and other technical journals. About two months ago we published a paragraph relating to certain cable matters, but which was contradicted in our columns the following week. This notice was copied by a score or more of provincial papers, the majority of which gave us due credit, and after a month had elapsed found its way into one of the London industrial weeklies without giving any credit or making any alteration. But more amusing than this is a paragraph which has within the past week appeared in a Tunbridge Wells daily. Over two years ago we published a paper read before the British Association at Edinburgh by Prof. Blyth, descriptive of his improved form of windmill. A paragraph was given on the subject by one of the provincial papers, and we at the time observed it going upon a lengthy tour, appearing in scores of London and country newspapers; doubtless it has now been copied from some foreign source into the columns of our Tunbridge Wells contemporary. The latter's notice would read as though Prof. Blyth read the paper this year at the British Association meeting, instead of two years ago.

The Five-Wire System at St. Pancras.—While walking through Camden Town during the past week, we saw that great changes were being made in the system of supply, it being no less than a transposition from the three to the five-wire system.

The Glasgow and West of Scotland Technical College.—Two of the engineering diploma associates and assistants of this college, who have been for several years connected with Prof. Jamieson's classes, have just obtained new appointments. Mr. John Anderson has been selected by Messrs. Caird & Co., of Greenock, as special calculator in connection with their engineering and shipbuilding refinements; and Mr. Robert M. Anderson, his younger brother, has been chosen from a number of applicants as an engineering lecturer in the Manchester Technical School. The Electrical Engineering Laboratory has just received a very handsome addition to its testing apparatus in the shape of a Siemens low resistances bridge, which is capable of accurately measuring resistances to the one-millionth of an ohm. This present is all the more acceptable since it has been given in recognition of the tests done by Prof. Jamieson's students during last session.

Finsbury Technical College.—At this college the autumn courses of lectures and laboratory work begin next week. On Mondays Prof. Silvanus P. Thompson will deal with alternate currents through the month of October, and in November will give four lectures specially upon modern alternate current motors. The Wednesday evening lectures (elementary course), after the introductory discourse on October 3rd by Prof. Thompson, will be taken by Mr. Eustace Thomas until November, when Prof. Thompson will take up measuring instruments. The laboratory courses remain, as heretofore, under the charge of Mr. E. A. O'Keeffe. The electroplating laboratory class, under Mr. Rousseau, will meet later in the session. Prof. Thompson's special course of lectures on "Central stations for electric lighting," are to be given on Thursdays at 7.30 p.m., commencing October 4th. Particulars of all these courses are to be obtained from the college registrar.

Telegraphic Delays.—At a meeting of the council of the Liverpool Chamber of Commerce on Wednesday, Mr. Hemelryk called attention to the delays in telegrams between Liverpool and the Continent, and to the stereotyped explanation of the Post Office that these were due to the "wires working badly." He believed that the postal authorities in fact did not take the trouble to enquire into the matter, inasmuch as some years ago, in the late Postmaster-General's time, complaints had been made and the matter had been remedied. Now, however, the delays had recommenced. He believed the chief blame to rest on the shoulders of the foreign telegraph offices; at any rate it was absurd that from a thousand miles away they could get a reply in half an hour, whilst from only a few hundred miles a reply came in five or six hours. A deputation was appointed to wait on the Postmaster-General.

The Medical Battery Company.—Yesterday, at the Guildhall Tavern, Mr. Lile presided over a meeting of creditors of "The Medical Battery Company, Limited," to consider a scheme for raising £3,000 to prevent the sale by the debenture holders of the property of the company. The chairman stated that unless the money was subscribed to reconstruct the company and carry on the business, the whole concern would be sold, and the creditors would get absolutely nothing. The decision must be arrived at that day, in order that the solicitor could be authorised to go to the Court and obtain an order to prevent the sale. The meeting lasted over an hour, and although several of the committee (including the chairman) promised to subscribe 20 per cent. of their indebtedness, very few of the creditors gave in their names, and one of the committee complained that only about £100 had been promised, and also stated that a previous circular with regard to forming a new company had absolutely met with no response. Several representatives of provincial creditors loudly complained that the matter was left until within a few hours of the time when a forced sale could be made, and stated that it was impossible to communicate with their chiefs before a sale might be affected.

Government and the Telephone.—At Tuesday's meeting of the Commissioners of Sewers, a letter from the General Post Office authorities, together with copy of return made by H.M. Postmaster-General to the House of Commons, containing drafts of proposed new agreements between the Post Office and the National Telephone Company and "New" Telephone Company, was referred to the Streets Committee.

Coast Communication.—A Ramsgate dissenting minister wrote to the *Daily Chronicle* last week contradicting a statement of another correspondent, which was to the effect that electrical communication with lightships is a failure. He asserts that the telephone line between the Goodwin Sands lightship and the shore has worked admirably for the last seven months:—

> One of her crew, a member of my church, had a son critically ill ashore while his father was doing his two months' on board. To relieve his anxiety I obtained permission at the coastguard station to speak the lightship. I told him the home news, and had with him a general chat. . . . . I easily recognised his voice, quite as well as I ever heard one through a land telephone. . . . . There are only two drawbacks:—(1) The chafe of cable near the ship necessitates frequent repairs. Experience will soon suggest some safeguard. (2) The ship does not ride rough seas so lightly as before, owing to her being anchored by four heavy chain cables instead of one. This, while no danger, is less comfortable for the crew, as she ships more seas aboard. It has been suggested that each cable should be supported by a buoy, which would probably remove this defect.

Heriot-Watt College, Edinburgh.—The Heriot-Watt College, Edinburgh, one of the most successful and progressive of existing institutions for providing higher general and technical education, has an interesting history. The present scheme of management originated in 1885, when a governing body was formed representing the amalgamation of three educational institutions, the School of Arts, the James Watt Institution, and the George Heriot Hospital. The School of Arts claimed to be the first institution in Great Britain founded for the express purpose of giving education in the principles of science to the industrial classes. It was established in 1821, Sir David Brewster being amongst its promoters. Three years later a movement was started to perpetuate the memory of James Watt, resulting in the erection of a memorial building, in which, very appropriately, accommodation was found for the School of Arts. As time advanced the Watt Institution and School of Arts widened its field of operations, and provided for the industrial classes, as far as possible, what the University gives to those destined for the learned professions. In 1885 an arrangement was come to by which the endowment of the Watt Institution was amalgamated with that of George Heriot Hospital, an educational institution founded by George Heriot, jeweller and money-lender to King James VI., at first in Edinburgh and afterwards in London. By the scheme of 1885 full provision is made for the maintenance, improvement and extension of the Watt Institution and School of Arts as a college for providing technical and general education for the industrial classes of both sexes. From that date the name of the institution was altered to the Heriot-Watt College. The calendar of the college for the coming session affords evidence that, though Edinburgh cannot be looked upon as an engineering centre, the classes in mechanical and electrical engineering and relative subjects are largely attended, the number down for electricity and magnetism last year being 158. To meet the wants of those who, for various reasons, are precluded from attending the more systematic courses of the day classes, evening courses are arranged for artisans, apprentices, telegraphists and others, with the aim of giving the student a more practical and productive knowledge than can be obtained from text-books. Under the superintendence of Prof. Mullineux Walmsley, D.Sc. (London), the courses in engineering and applied physics afford to the student every opportunity of becoming thoroughly acquainted, both theoretically and practically, with such subjects as electricity, heat, optics and acoustics, and following this up with general laboratory work, and finally such special practice as making and repairing electrical instruments, telegraphy, telephony, electrical transmission of power, construction of dynamos, lamps, &c. The more advanced course is sufficiently comprehensive and thorough to qualify students for responsible positions in the various industrial applications of electricity.

Wanted a Draughtsman.—We recommend to the notice of our readers an advertisement for a draughtsman which appears in the supplement. It will be seen that somebody is making an effort to secure the South Shields contract with drawings thrown in. We understand that the firm which seeks this assistance is a respectable one, and it is to be sincerely hoped that some kind-hearted draughtsman will come forward to help them in their hour of direst need.

Telegraphists' School of Science.—We have received a copy of the prospectus of the nineteenth annual session, which commences on Monday next, October 1st. Mr. W. Slingo is the principal, and Mr. A. Brooker is chief instructor; the other instructors being Messrs. Mansbridge, Miles, Martin, and Shaughnessy. The prospectus also contains a list of the prizes gained by students who entered for the Science and Art Department and City and Guilds' Institute's examinations. This school, in addition to taking the first prize in the kingdom in Telegraphy, is in the unique position of having sent in three candidates for honours in electricity and magnetism, and securing a medal in each case. We believe the School takes more certificates in telegraphy and telephony than all the other schools in the country put together.

First Aid in Electric Accidents.—The following letter appeared in the *Lancet* of 15th inst. from the pen of Dr. W. S. Hedley:—"For the information of those who are not medical men and electricians, the article on the pathology and treatment of electric accidents in the *Lancet* of August 25th may be suitably supplemented by briefly adverting to the question of first aid in such cases, and to certain risks attendant thereon. It is obvious that the first thing to do is to detach the body of the victim from the circuit with which it is in contact; but it is equally obvious that, as that body is forming part of the circuit, it would be dangerous to touch the skin with bare hands, inasmuch as anyone doing so would thereby 'shunt' a portion of the current through his own body. The clothing, if dry, would afford a considerable, but not quite adequate, protection; it is therefore necessary to improvise some kind of insulation for the hands of the rescuer. Further, as is well known, the muscles of a body traversed by an alternating current of high tension remain in a state of tonic contraction. In other words, a hand grasping a cable remains tightly clenched (the condition of 'fixation'), and detachment is not always easy. Such accidents generally occur by the completion of a circuit between the cable and the earth, but sometimes contact is made simultaneously with both poles of a circuit. The time seems to have arrived for the publication of some carefully considered authoritative code of instructions for the management of such accidents as well as for their prevention; in the meantime, however, such considerations as the foregoing would appear to point to the following:—Rules for guidance in electric accidents. 1. Break the circuit at once if there be an interrupter close at hand and you know how to use it; if not, lose no time, but proceed to rule 2. 2. Do not touch the man's body with your bare hands, but if India-rubber gloves are not at hand, pull him off the cable by his coat-tail, or fold your coat or some such dry article into two or three thicknesses, and, using this as a pad to take hold of the body, pull it away from the circuit and resort to rule 5. 3. If unable to get him off, raise with covered hands that part of the body which is touching the earth, or one of the poles of the circuit. This will break the circuit, and it will usually be thus possible to get him easily away, and, if so, proceed to rule 5. 4. If still unsuccessful, make another pad, and, placing it between the ground and that part of the body in contact with the ground, continue your efforts to detach him. 5. Having pulled him away from the cable, free his neck from clothing, and treat the case as one of drowning, one method being as follows. 6. Open his mouth, and, taking hold of the front part of the tongue with your fingers—covered with a handkerchief if you have one—draw the tongue forwards, and gradually let it go back 16 times a minute. Be sure that the root of the tongue is acted upon and drawn forward. If the teeth are clenched and you cannot get them apart with your fingers, gently separate them with the handle of a pocket-knife or by a small piece of wood, cork, &c. 7. Resist the efforts of the bystanders to pour stimulants down his throat until a medical man arrives and 'takes over' the case."

Traction in Paris.—Electrical traction is not making great progress in Paris. There was some talk recently of some trials of the Thomson-Houston tramways with overhead lines, which were to take place on the Boulevard Malesherbes. It seems even that some of the posts had been set up; then all at once these preparations were stopped. Meanwhile the Compagnie des Omnibus has been trying various systems of traction by means of compressed air. On September 18th a compressed air tramway entered upon service, running from the Place St. Augustin to the Cours de Vincennes. It is time, however, that experiments with regard to electric traction in Paris were undertaken seriously.

Our Telegraph System.—At the autumnal meetings held at Huddersfield recently, the Association of Chambers of Commerce passed the following resolution:—"That, in the opinion of this association, it is unfair to the public that the telegraphic department of the Post Office should, for financial purposes, be treated as a separate establishment, thereby causing unwarrantable delay in carrying out urgent and much needed reforms. That, inasmuch as the postal establishment and its various departments are in their entirety a financial success, the time has arrived when the address of not exceeding four words should be allowed free of charge in all telegrams, and that telegraphic communication should be extended to rural districts where practicable. That a deputation wait upon the Postmaster-General to urge upon him the desirability of adopting this suggestion."

Transmission of Power in the States.—The Stanley Electric Manufacturing Company, of Pittsfield, Mass., U.S.A., has closed a contract with the Montmorency Electric Power Company, of Quebec, Canada, for a large two-phase electric plant to be used in the transmission of power from the celebrated Montmorency Falls to the City of Quebec. The contract is for three 500 kilowatt alternators of the Stanley Company's new inductor type, to be located in the Montmorency Company's new power station at the Falls. A novel feature of the installation is, that no step-up transformers are to be used, but each alternator is to generate current at 5,500 volts pressure, which is to be transmitted by four wires a distance of about eight miles to a sub-station in the City of Quebec, where step-down transformers will reduce the potential to 2,000 volts, at which pressure the current will be distributed throughout the city. The drop on the line from the Falls to the city is estimated at 6 per cent. Stanley step-down transformers are to be used, and will be kept cool by air blasts. In addition to current for lighting, power will be furnished by two-phase motors. Continuous current is also to be supplied for street railway purposes by rotary transformers. The sub-station will contain switchboards for the two-phase light and power circuits, for the arc light circuits and for the street railway circuits.

New Alloys of Copper.—Some new alloys of copper are noticed by G. von Knorre in a German contemporary. The most important of them consists of copper, 64·78 per cent.; zinc, 29·50 per cent.; iron, 1·71 per cent.; aluminium, 1·70 per cent.; tin and antimony, 2·22 per cent. The specific gravity of this alloy is 8·077 at 16° C., its tensile strength 58 kil. per square mm., its coefficient of elasticity 48 kil. per square mm., and its elongation under tensile strain 14 per cent. in 100 mm. of original length. Another of these alloys contains copper 61·46 per cent.; lead, 0·86 per cent.; iron, 0·91 per cent.; manganese, 0·76 per cent.; and zinc, 35·98 per cent.; that is to say, it is an alloy of brass and lead, to which, on melting, ferro-manganese has been added as a reducing agent.

An Electrolytic Method for Joining Metal to Earthenware, &c.—One of the great difficulties in sanitary work experienced by plumbers is in making a true connection between lead pipes and the earthenware of closet pans and lavatory basins. A process has consequently been devised by W. B. H. Drayson, whereby the earthenware with which the connection is to be made, being unglazed, or the glaze having been removed, it is coated with plumbago and placed in an electrolytic bath, thus obtaining a metallic coating. The lead pipe can then be soldered to this coating in the ordinary way by means of a plumber's "wiped" joint. This process is designed to avoid the imperfect joints now commonly made with India-rubber sleeves, washers, or putty.

Atmospheric Conditions of Electrically Lighted Liners.—A correspondent of the *Lancet* has just completed a nine days' voyage across the Atlantic, and complains that several passengers were severely affected with insomnia and an exhilaration of a very marked degree, and which were not relieved by the usual narcotics. He attributes this effect to an "electrical condition generated by the machinery itself or by the dynamos used in lighting the ship." He recommends a most thorough investigation into the matter by competent specialists. The editor of the *Lancet*, in a footnote, gives the following very satisfactory answer:—

Continued proximity to the noise and vibration of machinery in motion may, no doubt, induce insomnia and similar conditions. It is necessary to speak guardedly of electrical possibilities; at the same time it is difficult to imagine that the plant used for electric lighting on board ship should have any effect different from that of other machinery. It may be remembered that a static discharge, a spark of considerable length, is often obtainable from the rapidly moving belt of a large machine. This is of frictional origin. But there is no evidence that the electrostatic stresses so produced will influence the living organism. Then comes the further question: Are the conditions of living on board an electrically lighted ship such that the body may at times be in a chronic state of unconsciously short-circuiting a leakage or other currents? It is difficult to realise such a possibility. It might, however, be interesting to know the system of wiring and distribution adopted in the ship in question. Before falling back upon the hypothesis suggested in the above letter, has the writer sufficiently eliminated other possible causes? Especially is he satisfied that the general electrical conditions of the atmosphere at the time were not sufficient to account for the symptoms named. Sleeplessness, headache, restless irritability, are often observed in susceptible persons just before a thunderstorm. There is also evidence that the electrical conditions of the atmosphere, by affecting the "respirability of the air," or more probably perhaps by a direct influence on the nervous centres, is sometimes a factor in the causation of "heat apoplexy." Such points are little understood and not sufficiently studied. Even now, however, by their aid the electro-therapist feebly gropes his way to a rational indication for the use of the so-called "static bath." It is possible that electricity, both within us and around us, will some day throw light upon many a dark point connected with conditions both of health and of disease.

Bleaching Starch, Dextrin, and Gum, by Means of Ozone.—Although methods of producing ozone electrically have been well known for many years, and its bleaching properties have often been expounded, there have been up to the present very few commercial applications of it. In Germany, however, an interesting system of utilising electrically produced ozone is being exploited in connection with the deodorising and bleaching of various amylaceous materials such as starch, dextrin, and gum. The ozone, or ozonised air, is prepared by passing oxygen or air through an apparatus in which a silent electrical discharge is produced by means of alternating high pressure currents. The gas is then blown into the liquid containing the starch, dextrin, or gum, through very fine apertures; or else these liquids are sprayed into a chamber charged with ozone. It is claimed that the appearance, odour, and general market value of these substances are greatly enhanced when thus subjected to a treatment with ozone.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Amalgamated Electricity Supply Company, Limited.—This company has been dissolved under Clause 7 (4) of the Companies' Acts, 1880 (43 Vict. Ch. 19), by notice in the *London Gazette*.

Electric Arms and Ammunition Syndicate, Limited (29,845).—This company's yearly return shows that out of a nominal capital of £40,000, in £100 shares, 290 shares have been taken up, and that £70 has been called up on each of 80 shares. A sum of £5,580 has been received, £21,000 has been agreed to be considered as paid, and £20 is outstanding.

Electric Lighting and General Development Syndicate, Limited (36,048).—This company's last return states that out of a nominal capital of £700, in £10 shares, 48 shares have been taken up, and that the full amount has been called on 28 of these. The sum received is £280, and £200 has been agreed to be considered as paid on 20 shares.

Eastern and South African Telegraph Company, Limited (13,306).—This company's yearly return, filed on the 20th ult., shows that with a nominal capital of £600,000, in £10 shares, the whole of these shares have been taken up, and that the full amount has been called and duly paid.

Foreign Pilsen Electric Light and Power Company, Limited (20,689).—This company's latest yearly return shows that out of a nominal capital of £30,000 in £1 shares, 29,800 shares have been taken up, and that the full amount has been called and paid on each.

Globe Telegraph and Trust Company, Limited (7,465 C).—On the 18th ult. this company filed its annual return, which shows that out of a nominal capital of £5,000,000 in 250,000 preference and an equal number of ordinary shares, 180,042 preference and 180,227 ordinary shares have been taken up, and that the full amount has been called and paid on each. The sum received is, therefore, £3,602,690.

Globe Electric Company, Limited (35,123).—The registered office of this company is now at 8, Wells Street, Oxford Street, W.

Dalziel's News Agency of America, Limited (35,197).—This company's last return shows that out of a nominal capital of £100,000, in 5,000 "A" and 5,000 "B" shares, all of £10 each, 1,700 "A" and 2,500 "B" shares have been taken up, and that £10 has been called on 1,200 of the former class. A sum of £11,900 has been received; £30,000 has been agreed to be considered as paid; and £100 is outstanding.

Electrical Installation Company, Limited (36,519).—The registered office of this company is now situated at 66, Victoria Street, S.W.

Crown Contract and Works Company, Limited (38,210).—The registered office of this company is now at 11, Mansion House Chambers, E.C.

Davis & Timmins, Limited (20,086).—The last annual return of this company shows that out of a nominal capital of £20,000, in £10 shares, 1,303 shares have been taken up, and that the full amount has been called. A sum of £10,030 has been received in response to calls, and £3,000 has been agreed to be considered as paid.

Dalziel's Cable News Agency, Limited (30,264).—This company's last return shows that out of a nominal capital of £1,000 in £5 shares, the whole has been taken up and fully paid.

Devonshire Electric Light and Power Supply Company, Limited (31,843).—Mr. V. B. D. Cooper, of 5, Victoria Street, S.W., writes the Registrar of Joint Stock Companies that the above concern has practically ceased to exist.

Fareham Electric Light Company, Limited (30,806).—This company's last return shows that out of a nominal capital of £5,000, in £1 shares, 4,154 shares have been taken and fully paid.

Durand Electric Petroleum and Gas Engine and Manufacturing Company, Limited (31,052).—This company has been dissolved under Clause 7 (4) of the Companies' Act (43 Vict., Ch. 19), by notice in the *London Gazette*.

Electrical Works Construction and Maintenance Company, Limited (26,006).—Mr. P. A. Latham informs the Registrar of Joint Stock Companies that the above concern has never done any business, and that no capital has ever been allotted.

Electric and General Investment Company, Limited (31,506).—This company's last return shows that out of a nominal capital of £200,000 in 39,900 ordinary and 100 founders' shares all of £5 each, 20,000 ordinary and the whole of the founders' shares have been taken up, and that £1 has been called on each of the former, and the full amount on each of the latter class. The total received is £20,500.

Electrical Advertising Syndicate, Limited (33,896).—The registered office of this company is now at 11, King William Street, E.C.

City of London Electric Lighting Company, Limited (34,406).—The last return of this company shows that the whole of the nominal capital of £800,000, in 40,000 ordinary and 40,000 preference shares, all of £10 each, has been taken up and fully paid.

CITY NOTES.

The Brush Company's Report.

The excellence of the report just issued is beyond question. It is generally admitted that the electrical industry has had a bad time of it during the past nine months; but the depression has not seriously affected the year's work, for what has been lost by fall in prices has been compensated by an increased volume of business. The profit and loss account report shows a gross profit of £57,157, against £49,405 last year, the net profit being £27,280, which approaches the sum obtained in the exceptionally good year of 1892. The 6 per cent. on the preference shares is still maintained, but the dividend on the ordinary shares falls from 6 to 5 per cent. So many contracts were placed with the Brush Company during the past year, that it would not have been surprising to have seen a demand for more capital. This has been staved off, apparently, by a loan from the bankers of £25,000, a wise step to take under the circumstances. The lamp business carried on at Vienna is in a glowing condition, and we are glad to note some improvement in the unfortunate Australian department.

The Halifax Mutual Electric Light and Power Company, Limited.

A general meeting of the above company will be held at the office of the liquidator, Town Hall Buildings, Halifax, on October 25th, 1894, at 12 o'clock at noon, for the purpose of having an account laid before them, showing the manner in which the winding-up has been conducted, and the property of the company disposed of, and of hearing any explanation that may be given by the liquidator; and also of determining, by extraordinary resolution, the manner in which the books, accounts and documents of the company, and of the liquidator thereof, shall be disposed of.

The Brush Electrical Engineering Company, Limited.

The fifth annual report to be presented to the shareholders at the general meeting of the company to be held at Cannon Street Hotel, London, E.C., on Monday, October 1st, 1894, at 3 p.m., states that the profit and loss account shows a gross profit of £57,157 19s. 4d. After deducting general charges, maintenance of buildings, plant and patents, interest on debenture stock, and sundry costs of removal, which the directors consider should be written off the year's profit, there remains a net balance of profit amounting to £27,280 12s. 1d., to which must be added the sum of £815 5s. 3d., the balance brought forward from last account. After providing the full dividend on the 6 per cent. preference shares for the year, and an interim dividend at the rate of 5 per cent. per annum, which has already been paid on the ordinary shares for the half-year ended December 31st, 1893, the directors recommend that a further dividend at the rate of 5 per cent. per annum be paid on the ordinary shares for the six months ended June 30th, 1894, leaving £3,788 9s. to be carried forward. During the year the sum of £3,710 13s. 7d. has been expended on the purchase of additional plant and extensions at the Loughborough works, where the whole of the regular home manufacturing work of the company is now concentrated and carried on. The volume of business which the company has been called on to undertake during the year is again in excess of that in any previous period of its existence. The prevalent industrial depression has, however, brought with it increased competition and a general fall in prices, with consequent diminution in the rate of profits obtainable. The company's Vienna factory has yielded improved results during the past year, and shows a fair return upon the capital employed. Important central station contracts have been successfully carried out, and others are in course of execution. The glow lamp department has during the year largely increased its output, and is now manufacturing at the rate of half a million lamps per annum. The Australian branch of the business has laboured under great disadvantages, arising out of the financial crisis through which the Colonies have recently been passing; under these circumstances the directors are glad to be able to state that the bad debts incurred during the year amount to less than £50, and consider that great credit is due to the careful management with which the business has been conducted. The works of the company are at present fully employed, and the prospects for the coming year are satisfactory. The progressive change in the character of the industry from the lighter class of electrical engineering involved in numerous and isolated installations, to the heavier and more considerable works following upon the extension of electricity supply from central stations, is undoubtedly favourable to this company. The contract with the City of London Electric Lighting Company for the supply and erection of generating plant and accessories for public and private lighting in the City of London has made satisfactory advance during the year. Contracts have also been entered into with the County of London and Brush Provincial Electric Lighting Company for the supply of plant and equipment of central station undertakings for the districts of St. Luke's, Wandsworth and elsewhere. Mr. Arthur Ayres, M.Inst.C.E., has accepted a position upon the board, to fill the vacancy created by the death of

the late Duke of Marlborough. Mr. A. H. Sanderson and Colonel F. G. Steuart retire by rotation, and, being eligible, offer themselves for re-election. The auditors, Messrs. Cooper Brothers & Co., also retire and offer themselves for re-election.

BALANCE-SHEET, June 30th, 1894.

Dr.	£	s.	d.	£	s.	d.
To Authorised capital	750,000	0	0			
„ Capital issued, viz.:—						
90,000 6 per cent. preference shares of £2 each	180,000	0	0			
90,000 ordinary shares of £3 each	270,000	0	0			
				450,000	0	0
„ 4½ per cent. perpetual debenture stock				125,000	0	0
„ Creditors—						
Sundry creditors	62,237	2	1			
Bills payable	10,087	12	11			
				72,324	15	0
„ Loan from bankers on security				25,000	0	0
„ Provision for depreciation on property, patents and goodwill account—						
Transferred, see per contra ...	9,000	0	0			
Deduct balance of cost of Manchester and Cardiff stations closed during the year	3,614	17	11			
				5,385	2	1
„ Reserve account, as per last account, less £554 13s. 5d. applied during the year				1,058	12	0
„ Profit and loss account—						
Balance as per last account ...	815	5	3			
„ of profit and loss account	27,280	12	1			
	28,095	17	4			
Less interim dividend paid on preference and ordinary shares	12,157	8	4			
				15,938	9	0
NOTE.—Contingent liability in respect of uncalled capital on shares in other companies and on bills receivable discounted £39,687						
				£694,706	18	1

Cr.	£	s.	d.	£	s	d.
By Property, patents and goodwill—						
As per last account	280,270	0	11			
Amount previously written off transferred to provision for depreciation per contra	9,000	0	0			
	289,270	0	11			
Additions to plant... £3,710 13 7						
Purchase of new patent 75 0 0						
	3,785	13	7			
	293,055	14	6			
Deduct—						
Property and plant disposed of during the year £5,237 13 5						
Amortisation of lease 733 6 10						
	5,971	0	3			
				287,084	14	3
„ Stock—						
Goods in hand in process of manufacture, work in progress and materials in London, at Loughborough, and other places...				114,681	1	5
„ Debtors—						
Sundry accounts	156,244	12	11			
Bills receivable	2,446	18	9			
				158,691	11	8
„ Cash at bankers, and in hand				12,965	3	9
„ Shares and debentures in other companies ...				42,914	16	7
„ Liquidators' balances and suspense accounts ...				2,110	12	2
„ Balance of foreign and colonial branches accounts, being excess of assets over liabilities				76,258	18	3
				£694,706	18	1

APPROPRIATION ACCOUNT.

Dr.	£	s.	d.
To Further dividend on preference shares at the rate of 6 per cent. per annum, and on ordinary shares at the rate of 5 per cent. per annum ...	12,150	0	0
„ Balance carried forward	3,788	9	0
	£15,938	9	0

Cr.	£	s.	d.
By Balance	15,938	9	0
	£15,938	9	0

PROFIT AND LOSS ACCOUNT for the year ended June 30th, 1894.

Dr.	£	s.	d.	£	s.	d.
To General charges, viz.:—						
Directors' fees	1,934	15	10			
Auditors' fees	105	0	0			
Salaries	8,303	3	6			
Staff bonuses	2,190	18	7			
Law charges	267	1	7			
Insurance	770	2	5			
Postage, stationery, and printing	1,177	0	0			
Travelling, carriage, and freight ...	1,093	11	7			
Advertising, agency, and sundries	4,072	12	0			
				19,974	5	6
„ Cost of removal to Loughborough				632	0	8
„ „ from Hammersmith				107	19	7
„ Maintenance of buildings and plant				3,393	12	10
„ „ patents				144	8	8
„ Interest on debenture stock to June 30th, 1894 ...				5,625	0	0
„ Balance, profit carried to balance-sheet				27,280	12	1
				£57,157	19	4

Cr.	£	s.	d.
By Gross profit	57,157	19	4
	£57,157	19	4

The Direct Spanish Telegraph Company.

THE annual meeting of this company was held on Friday last at Winchester House.

The CHAIRMAN, in his opening remarks, commented on the decrease in traffic receipts which they had experienced during the past year. There was a decrease of £868 compared with 1893. He would remark, however, that quite recently there had been a marked increase whether this would continue he was unable to say, but it certainly appeared that trade was improving steadily, due to the settlement of new tariff in America. They knew from their experience, and he himself had received private intimation, that things were improving in Spain; if such were the case, they would benefit as well as everybody else. Working expenses were practically as they were last year. They all knew that it was impossible to reduce working expenses because the traffic fell off; if they did, they would immediately traffic revived, come to a deadlock. The Chairman then went on to mention the various other items in the accounts which have been already referred to in the directors' report, such as the new breakwater at Bilbao, rendering it necessary for the company to seek another landing place, and the changes which had been made in the debenture stock.

After a short discussion the report was adopted and the meeting terminated.

Edmundsons, Limited.

THE sixth annual meeting of this company was held at the offices, No. 19, Great George Street, Westminster, on September 13th, 1894, Joshua W. Edmundson, Esq., presiding. In moving the adoption of the report, the CHAIRMAN congratulated the shareholders upon a satisfactory year's working. Although the profits for the past year were not so large as in several previous years, they were satisfactory when the great depression in trade and the large amount of competion were taken into account. The outlook for the present year was satisfactory, as they had a larger amount of work in progress than was the case at the same time last year, including, among other installations, the lighting of Warwick Castle for the Earl of Warwick, Duncombe Park for the Earl of Feversham, Elveden Hall for Lord Iveagh, Copped Hall for E. J. Wythes, Esq., Nidd Hall for the Hon. H. E. Butler, Wood Hall for J. W. Hutchison, Esq, and the New Asylum for Sunderland. An important contract has also just been signed for lighting a portion of the town of Shrewsbury, provision being made in the first instance for 5,000 lights, and the directors hope they may be able to extend the company's operations in this class of work. The report and accounts were unanimously adopted, and a resolution passed directing the payment of a dividend at the rate of 6 per cent. per annum, on both preference and ordinary shares. Mr. Henry Wigham, the retiring director, was re-elected, as were also the auditors, Messrs. May and Street.

Anglo-American Telegraph Company, Limited.—The directors have resolved, after placing £6,000 to the credit of the renewal fund, to declare an interim dividend for the quarter ending September 30th, 1894, of 9s. per cent. on the ordinary stock, and 18s. per cent. on the preferred stock, less income tax, payable on November 1st to the stockholders registered on the books of the company on September 30th, 1894.

TRAFFIC RECEIPTS.

The City and South London Railway Company. The receipts for the week ending September 23rd, 1894, amounted to £835; week ending September 24th, 1893, £775; increase, £60; total receipts for half-year, 1894, £10,237; corresponding period, 1893, £9,681; increase, £556.

The Liverpool Overhead Railway Company. The traffic receipts for the week ending September 23rd, 1894, amounted to £955; corresponding week last year, £687.

The Western and Brazilian Telegraph Company, **Limited. The receipts for the week ending** September 21st, after deducting **17 per cent. of the gross receipts payable to the London** Platino-**Brazilian Telegraph** Company, **Limited, were £**3,598.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1891.	1892.	1893.	Closing Quotation September 19th.	Closing Quotation. September 26th.	Business done during week ended September 26th, 1894. Highest.	Lowest.
184,500£	African Direct Teleg, Ltd., 4 % Deb.	100	...	...	...	102 —105	102 —105	103½	103
1,134,640£	Anglo-American Teleg., Ltd.	Stock	£2 12s.	£2 15s.	£2 11s.	40 — 43	39 — 42	39	...
2,932,680£	Do. do. 6 % Pref.	Stock	£5 5s	£5 10s.	£5 2s.	74 — 76	74 — 76	75½	75
2,932,680£	Do. do. Defd.	Stock	...	...	...	6¾ — 7¼	6¾ — 7¼	7¼	7
130,000	Brazilian Submarine Teleg., Ltd.	10	8 % §	6½% §	6½% §	12¾ — 13¼	12¾ — 13¼	12 5/16	...
75,000£	Do. do. 5 %, repayable June 1906	100	...	...	...	109 —113	109 —113	...	...
44,000	Chili Telep., Ltd., Nos. 1 to 40,000	5	... §	10%‖ §	... §	1 — 2	1½ — 2½	...	...
10,000,000$	Commercial Cable Co.	$100	7 %	7 %	7 %	140 —145	140 —145	...	...
224,850	Consolidated Telep. Const. and Main., Ltd. ...	10/-	3½% §	2 % §	2 % §	⅛ — ¼	⅛ — ¼	⅛	...
16,000	Cuba Teleg., Ltd.	10	8 %	8 %	8 %	12 — 13	12 — 13	13	...
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	19 — 20	19 — 20	...	...
12,931	Direct Spanish Teleg., Ltd., £4 paid	5	4½%	4 %	4 %	4¼ — 4¾	4¼ — 4¾	4 7/16	4¼
6,000	Do. do. 10 % Pref.	5	10 %	10 %	10 %	9½ — 10	9½ — 10	9 11/16	...
30,000£	Do. do. 4½ % Debs of £50, Nos. 1 to 1,600	...	...	...	...	105 —108%	105 —108%	...	...
60,710	Direct United States Cable, Ltd., 1877	20	3½% §	3½% §	2½% §	8¼ — 9	8¾ — 9¼	9⅛	8¾
400,000	Eastern Teleg., Ltd., Nos. 1 to 400,000	10	6½% §	6½% §	6½% §	15¾ — 16	15¾ — 16	16	15 13/16
70,000	Do. 6 % Pref.	10	6 % §	6 % §	6 % §	16¼ — 17	16¾ — 17¼	16 15/16	16⅝
105,900£	Do. 5 % Debs., repay. August, 1899	100	...	...	...	106 —110	106 —110	...	...
1.294,100£	Do. 4 % Mort. Deb.	Stock	...	...	...	118 —121	118 —121	120½	118¾
250,000	Eastern Extension, Australasia and China Teleg., Ltd. ...	10	7 %	7 %	7 %	15¾ — 16	15⅞ — 16⅛	16⅛	15 13/16
62,700£	Do. 5 % (Aus. Gov. Sub.), Deb., 1900, red. ann. drgs. reg. 1 to 1,049, 3,976 to 4,326	100	...	...	...	103 —106	103 —106	...	...
222,800£	Do. do. Bearer, 1,050—3,975 and 4,327—6,400	100	...	...	...	103 —106	103 —106	...	...
320,000£	Do. 4 % Deb. Stock	Stock	...	...	...	116 —120	116 —120	117¼	...
95,100£	Eastern and South African Teleg., Ltd., 5 % Mort. Deb. 1900 redeem. ann. drgs., Reg. Nos. 1 to 2,343	100	...	...	...	103 —106	103 —106	...	...
129,100£	Do. do. do. to bearer, 2,344 to 5,500	...	...	...	...	103 —106	103 —106	...	...
300,000£	Do. 4 % Mort. Debs. Nos. 1 to 2,016, red. 1909	100	...	...	...	103 —106	103 —106	104	...
200,000£	Do. 4 % Reg. Mt. Debs. (Mauritius Sub.) 1 to 8,000	25	...	...	...	108 —111%	108 —111%	...	...
180,227	Globe Telegraph and Trust, Ltd.	10	5½% §	4⅞% §	4⅝% §	8¾ — 9	8¾ — 9	9	8¾
180,042	Do. do. 6 % Pref.	10	6 % §	6 % §	6 % §	15⅞ — 16¼	15¾ — 16¼	16⅛	15 13/16
150,000	Great Northern Teleg. Company of Copenhagen	10	8⅜% §	8⅜% §	8⅜%	20½ — 21½	20½ — 21½	20 13/16	20½
200,000£	Do. do. do. 5 % Debs.	100	...	...	...	103 —106	103 —106	...	...
17,000	Indo-European Teleg., Ltd.	25	10 %	10 %	10 %	46 — 48	46 — 48	...	...
37,548	London Platino-Brazilian Teleg., Ltd.	10	...	...	...	5 — 7	5 — 7	...	...
100,000£	Do. do. 6 % Debs.	100	...	...	...	106 —109	106 —109	...	...
15,000	Monte Video Teleph. Co., Ord., 1 to 15,000	5	...	...	...	¼ — ⅜	¼ — ⅜	...	...
28,000	Do. do. 6 % Pref., 1 to 28,000	5	...	...	...	1 — 1⅛	1 — 1⅛	...	...
484,597	National Teleph., Ltd., 1 to 438,984	5	6 % §	5 % §	5 % §	4⅞ — 5⅛	4⅞ — 5⅛	5 1/16	4 15/16
15,000	Do. 6 % Cum. 1st Pref.	10	...	...	...	14½ — 15½	15 — 15½	15⅛	15⅛
15,000	Do. 6 % Cum. 2nd Pref.	10	...	...	...	14 — 15	14 — 15	14¼	14¼
119,234	Do. 5 % Non-cum. 3rd Pref., 1 to 90,950	5	...	...	...	5½ — 5¾	5½ — 5¾	5 11/16	5⅝
925,017£	Do. 4½ % Deb. Stock Prov. Certs. ...	...	...	...	...	109 —112	109 —112	...	...
48,800	New Teleph., Ltd., 25,901 to 74,700; £4 paid	10	...	...	...	... ...	... ...	...	...
171,504	Oriental Teleph. & Elec., Ltd., Nos. 1 to 171,504, fully paid	1	...	...	...	⅛ — ⅜	⅛ — ⅜	...	...
100,000£	Pacific and European Tel., Ltd., 4 % Guar. Debs, 1 to 1,000	100	...	...	...	104 —107	104 —107	...	...
11,839	Reuter's Ltd.	8	5 %	5 %	0 %	3 — 5	3 — 5	...	...
3,381	Submarine Cables Trust	Cert.	...	...	...	107 —112	105 —110	109	...
58,000	United River Plate Teleph., Ltd.	5	...	...	...	1¼ — 2½	2 — 3	...	...
146,370£	Do. do. 5 % Debs.	Stock	...	...	...	88 — 94	88 — 94	...	...
15,609	West African Teleg., Ltd., 7,501 to 23,109	10	4 %	..	0 %	3 — 5	3 — 5	...	...
249,900£	Do. do. do. 5 % Debs.	100	...	...	...	100 —103	100 —103	101¾	...
30,000	West Coast of America Teleg., Ltd.	10	...	...	...	2 — 3	2 — 3	...	...
150,000£	Do. do. do. 8 % Debs., repay. 1902	100	...	...	...	101 —106	101 —106	...	...
64,242	Western and Brazilian Teleg., Ltd.	15	4 %	2½%	2½%	8¾ — 9¼	8¾ — 9¼	9 7/16	8⅞
33,129	Do. do. do. 5 % Cum. Pref. ...	7½	...	...	...	6¾ — 7¼	6¾ — 7¼	7¼	6 13/16
33,129	Do. do. do. 5 % Def.	7½	3 %	...	...	3 — 3½	2¾ — 3¼	3½	3
178,200£	Do. do. do. 6 % Debs. "A," 1910 ...	100	...	...	...	106 —109	106 —109	...	...
222,700£	Do. 6 % Mort. Debs., series "B," red. Feb. 1910	100	...	...	...	106 —109	106 —109	...	...
88,321	West India and Panama Teleg., Ltd.	10	¼%	¼%	⅜%	1¼ — 1½	1⅜ — 1⅝	1⅛	1⅜
34,563	Do. do. do. 6 % 1st Pref. ...	10	...	...	...	10½ — 11	10¾ — 11¼	10 15/16	10⅝
4,669	Do. do. do. 6 % 2nd Pref. ...	10	...	...	..	9 — 10	9 — 10	9 1/16	...
80,000£	Do. do. 5 % Debs. (1917) No. 1 to 1,000	100	...	...	...	108 —111	108 —111	...	...
$1,214,000	Western Union of U. S. Teleg., 7 % 1st Mort. Bonds ...	$1000	...	...	...	115 —120	115 —120	...	...
169,000£	Do. do. 6 % Ster. Bonds.	100	...	...	...	100 —103	100 —103	...	...

ELECTRICITY SUPPLY COMPANIES.

20,510	Charing Cross and Strand Electy. Supply, 1 to 6, 215 to 718, and 10,001 to 30,000	5	...	5 %	4½%	4½ — 5½	4½ — 5½	...	...
40,000	City of London Elec. Lightg. Co., Ltd., Ord. 40,001—80,000	10	...	...	...	12½ — 13½	13 — 14	13⅝	13¾
40,000	Do. do. 6 % Cum. Pref., 1 to 40,000	10	...	6 %	6 %	14¼ — 14¾	14½ — 15	14¾	13½
100,000	Do. 5 % Deb. Stock, Scrip. (iss. at £115) all paid	...	...	...	...	130 —132	130 —132	...	...
50,000	†Liverpool Electric Supply, £4 10s. paid	5	4½%	5 %	5 %	6¾ — 7	6¾ — 7	...	...
49,900	*Metropolitan Electric Supply, Ltd., 6,101 to 50,000 ...	10	1 %	2 %	2½%	9½ — 10	9½ — 10	9⅞	9⅝
100,000£	Do. 5% Deb., 1 to 10,000 in bonds of £10, £20, £40	...	...	...	...	... — ...	... — ...	...	...
6,452	Notting Hill Electric Lightg. Co., Ltd.	10	...	...	...	4½ — 5½	5 — 6	...	...
19,980	St. James's & Pall Mall Elec. Light Co., Ltd., Ord., 101-18,780	5	8½%	7½%	4½%	6¾ — 7¼	7 — 7½	7 3/16	7⅛
20,000	Do. do. 7 % Pref., 20,081 to 40,080	5	7 %	7 %	7 %	8½ — 9	8½ — 9	8½	...
59,900	*Westminster Electric Supply Corp., Ord., 101 to 60,000 ...	5	...	3½%	4 %	6¼ — 6¾	6¼ — 6¾	6⅝	6⅝

* Subject to Founder's Shares. † Quotations on Liverpool Stock Exchange.

‡ Unless otherwise stated all shares are fully paid. ‖ Dividends paid in deferred share warrants, profits being used as capital.

Dividends marked § are for a year consisting of the latter part of one year and the first part of the next.

SHARE LIST OF ELECTRICAL COMPANIES—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL, COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1891.	1892.	1893.	Closing Quotation, Sept. 19th.	Closing Quotation, Sept. 26th.	Business done during week ended Sept. 26th, 1894. Highest.	Lowest.
90,000	Brush Elecl. Enging. Co., Ord., 1 to 90,000	3	...	6 % §	6 % §	2⅝— 2⅞	2⅝— 2⅞	2 1/16	2 1/16
90,000	Do. do. Non-cum. 6 % Pref., 1 to 90,000	2	...	6 % §	6 % §	2⅜— 2⅝	2⅜— 2⅝	2⅝	2½
125,000/	Do. do. 4½ % Deb.	Stock	...	...	...	109 —112	109 —112	...	...
630,000/	City and South London Railway	Stock	...	⅝%	⅝%	36 — 38	36 — 38	...	...
28,180	Crompton & Co., Ltd., 7 % Cum. Pref. Shares, 1 to 28,180	5	7 % §	7 % §	7 % §	1¾— 2¼	1¾— 2¼	...	...
50,000/	Do. do. 5 % 1st Mort. Debs., 1—400 of £100, and "A" 1—200 of £50 each	...	...	...	...	95 —100	95 —100	...	...
120,000	Electric Construction, Ltd., 1 to 120,000	2	...	...	...	⅛— ¼	⅛— ¼	5/16	9/16
12,845	Do. do. 7 % Cum. Pref., 1 to 12,845 ...	2	...	...	...	2 — 2½	1¾— 2¼	2¼	...
100,000	Elmore's French Patent Cop. Deposg., Ltd, 1 to 66,750 ...	2	*nil*	*nil*	*nil*	1/16— 3/16	3/16— 5/16	...	...
91,195	Elmore's Patent Cop. Deposg., Ltd., 1 to 70,000	2	*nil* ¶	*nil*	*nil*	1 5/16— 1 7/16	1 5/16— 1 7/16	...	...
67,385	Elmore's Wire Mfg., Ltd., 1 to 67,385, issued at 1 pm. ...	2	*nil*	*nil*	*nil*	1 1/16— 1 3/16	1 1/16— 1 3/16	...	...
20,000	Fowler-Waring Cables, Nos. 301 to 20,300	5	*nil* §	*nil* §	*nil* §	½— 1½	½— 1½	...	...
9,600/	Greenwood & Batley, Ltd., 7 % Cum. Pref., 1 to 9,600 ...	10	7 %	...	...	6½— 7½	6½— 7½	...	...
6,837	Henley's (W. T.) Telegraph Works, Ltd., Ord.	10	5 %	5 %	5 %	7½— 8½	7½— 8½	...	...
50,000	India-Rubber, Gutta Percha and Teleg. Works, Ltd. ...	10	12½%	12½%	12½%	23½— 24½	23½— 24½	24 7/16	23⅝
200,000	Do. do. do. 4½ % Deb., 1896	100	...	...	...	104 —105	102 —104	105	...
37,500	†Liverpool Overhead Railway, Ord.	10	...	...	1 %	7⅞— 8	7⅞— 8¼	...	...
6,295	† Do. do. Pref., £8 paid	10	...	...	...	12¾— 13	12¾— 13	...	...
	Swan United Electric Light, Ltd.	...	11 % §	10 % §	7½% §	... — ...	... — ...	...	...
37,350	Telegraph Constn. and Maintce., Ltd.	12	20 %	15 %	20 %	41 — 43	41 — 43	42¼	42
150,000/	Do. do. do. 5 % Bonds, red. 1894	100	...	...	...	102—105	102 —105	...	...
54,000	Waterloo and City Railway, Nos. 1 to 54,000, £2 paid ...	10	...	...	...	2 — 2¼	2 — 2¼	...	...

† Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. ¶ Last dividend paid was 50% for 1890.

Dividends marked § are for a year consisting of the latter part of one year and the first part of the next.

CROMPTON & Co.—The dividends paid on the ordinary shares (which have not a Stock Exchange quotation), are as follows: 1892—0%§; 1891—7%§; 1890—8%§.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

Birmingham Electric Supply Company, Ordinary of £5 (fully paid), 5¼—5⅝.

Electric Construction Corporation, 6 % Debentures, 87—92.

Electric and General Investment, shares of £5 (£1 paid), 1⅜—2¼.

Electricity Supply Corporation, Ordinary of £5, 5—5¼.

House-to-House Company (£5 paid), 1—1½.

Do. do. 7 % Preference, of £5, 5¼—5½.

Do. do. 6 % Debentures of £100, 101—103.

Kensington and Knightsbridge Electric Lighting Company, Limited, Ordinary Shares £5 (fully paid) 4⅜—5¼; 1st Preference Cumulative 6 %, £5 (fully paid), 6½—6⅝.

Liverpool Electric Supply, £5 (fully paid), 6⅜—6½.

Do. do. £3 10s. paid, 4½—4⅝.

London Electric Supply Corporation, £5 Ordinary, ⅝—1½.

Queen Anne's Mansions Lighting and Heating Company, 6 % £100 Debentures, 101—103.

Yorkshire House-to-House Electricity Company, £5 Ordinary Shares (£4 10s. paid), 4¼—4⅜.

Bank rate of discount, 2 per cent. (February 22nd, 1894).

GASEOUS FUEL.

Electrical Engineering, in a recent issue, abstracted from the American *Gas Light Journal* an article by W. H. Blauvelt on gaseous fuel, which is noticeable as advocating the hot blast in boiler practice. Heating the air supply to a steam boiler furnace has frequently proved a failure in trials made with it, but it is not easy to understand why it should be so. It is here argued that when gaseous fuel is used it enters the combustion chamber at 600° Fahr. and the air enters at 50°. There is thus lost when burning the gas from a lb. of coal the heat absorbed in raising about 9·3 lbs. of air from 50° to 600° if this latter figure represent the chimney temperature. This loss is 8·8 per cent. of the total energy of the coal, being 1,279 thermal units. Adding the loss in the producer gives 16·8 per cent. of total loss under the conditions assumed. It is then stated that the loss due to coal burned direct is that due to raising 24·87 lbs. of gas through 550° Fahr. Here we conclude that the assumed condition is that the solid fuel requires a large excess of air. This loss is 3,420 units or 23·8 per cent. of the total energy of the coal or 7 per cent. more than when gas is used, which latter would therefore do 9·2 per cent. more work. Then there are other losses due to solid fuel. Of course the difference may be more or less than this, sometimes as high as 35 per cent. in favour of gas, at others the gas may prove a loss. Gas fuel, however, has the advantage of being easier applied to heating the air required for combustion than solid fuel. In the foregoing case could the air have been heated to 325° Fahr., and this is easily done, there would be saved 4·4 per cent. of the fuel energy, the total loss being only 12·4 as against 23·8 for solid fuel. The case has, however, been taken badly for solid fuel. Mr. Longridge has found as little as about 14 lbs. of air per lb. of coal to be used.

It is further claimed that gaseous fuel will give larger results in evaporation, and is easier maintained at its maximum economy, being so easily regulated and steam is more regularly produced. Further, the boilers are less liable to unequal temperatures and should wear longer. Now, we admit all this, but hardly think the case fairly put for solid fuel. Gas is produced in a lined chamber and served hot to the boiler in a state of incandescence, only waiting oxygen to spring into flame. There is no cold application to the gases; they are kept as hot as the limited combustion to which they are subject in manufacture can make them. With solid fuel this is all changed. The cold fuel is put into a water-cooled box and fed with cold air, and it is not to be wondered at that it fails to give great satisfaction. Were the same rational treatment meted out to solid fuel by burning it in a refractory lined furnace, there would not be the same necessity for excess of air that there now is, and the loss would be as low as with gaseous fuel, and it would be easier to regulate and vary the rate of combustion without smoke, while the ability to heat the air for combustion would be on a par also. So long, therefore, as solid fuel must be brought upon the ground we do not see much chance of any advantage being secured by converting it into gas, though we would certainly advocate a non-radiating combustion chamber. Mr. Blauvelt considers, however, that solid fuel has the advantage of the radiant heat of the bed of fuel on the grate, though he admits ignorance of the amount or the evaporative value. He thinks there can be no doubt that coal gives a higher evaporation per unit of surface than gas, though at a lower efficiency of the fuel. For our own part we too have a predeliction in favour of a radiating mass; but is it not reasonable to suppose that if really necessary such effect can be secured by a cellular arrangement of brick in place of the firegrate, the gas either from the producer or from the refractory furnace entering by way of such mass with any further necessary air and issuing over its surface which will become radiantly incandescent. Then, too, the use of Serve tubes and of ribbed plates is all in favour of the more scientific methods of combustion. With solid fuel in an external furnace the opening of the door may be guarded against by a simultaneously closing damper to check the rush of cold air to the boiler, but mechanical stoking ought to be particularly applicable to such a furnace and the opening of the door a rare occurrence. It may be possible, should there prove to be any advantage in limiting the supply of air in the furnace proper, to do this in so hot a chamber without delivering the gases in a smoky condition to the boiler where they would complete their combustion within and as they issued from the cellular bricks, to which the little additional air would be supplied hot; actual test alone would determine the possibility of doing this smokelessly and economically.

Speaking of smoke, our author says many hydrocarbons, when heated to suitable temperatures are decomposed into lower hydrocarbons and solid carbon which becomes soot if not supplied with air at a proper temperature for combustion; also, smoke is formed by the quenching of flame on cold surfaces. This is the main cause in ordinary boiler furnaces and not easy to completely overcome in ordinary furnaces. He states that both forms of soot may be prevented by intimate mixture with a proper amount of air at the moment of formation, but that the quenching action of the cold surfaces can only be overcome by allowing combustion to be either complete or well established before contact, all which we have before now emphasised; conditions, he goes on to say, easily secured with gas but not with solid fuel. He has secured with gas an increased evaporation of 12 per cent. over that secured from the same fuel burned solid, and done it without smoke or hot air. He appears to have employed a brick combustion chamber and to be at one with us in the general idea, for practically there is not much difference between his idea with gas producer and the brick furnace box for solid fuel. Seeing how good are the results now obtained with ordinary water cooled furnaces, is it not extremely probable that even a partial application of the principles, we are by no means now alone in advocating, would be sufficient to secure smokelessness with even the most difficult of the bituminous coals? We are much inclined to think so when we call to mind the many different schemes we have seen tried. W. H. B.

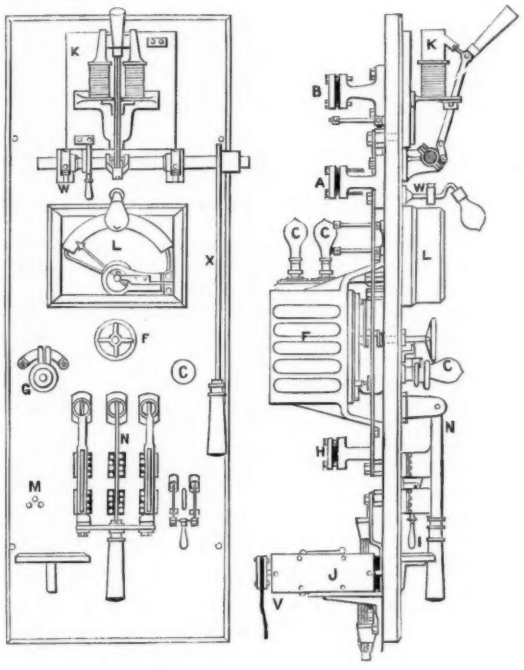
THE LYONS-OULLINS ELECTRICAL TRAMWAY.*

By. J. BERTHON.

(*Continued from page* 29.)

The Distribution Board.

The distribution board consists of two slabs of slate, polished and varnished (one for each machine), on which are placed the instruments required for the working of the two dynamos.



Figs. 5 and 6.—Front and Side Views of the Distribution Board.

Details of Figures 5, 6 and 7.

A, Bar connected with the line.
B, Bar connected with the rails.
C, Resistance formed of lamps.
D, Wires of the lamps of the board.
E, Wires for the lighting.
F, Rheostat.
G, Switch of the excitation circuit.
H, Equalising bar (on the board).
I, Principal switch of the lighting circuit.
J, Lightning guard.
K, Automatic cut-out.
L, Ampèremeter.
M, Terminals for the voltmeter.
N, Principal switch.
O, Equalising wire.
P, Fusible lead.
P', Fusible lead of the voltmeter circuit.
Q, German silver shunt.
R, Arrangement for tightening the feeders.
S, Negative wire.
T, Positive wire.
U, Principal switch of the lighting circuit.
V, Connection to earth.
W, Disconnecting apparatus.
X, Connecting apparatus.

The instruments placed on one of the slabs are as follows:

A tripolar commutator for the principal circuit.

A rheostat for the excitation furnished with lamps and a commutator.

An ampère-meter.

An automatic cut-out with making and breaking apparatus.

A lightning guard.

Terminals for taking the potential.

A cut-out with fuse for the voltmeter circuit.

A bipolar commutator for the lighting circuit.

A cut-out with fuse for the lighting circuit.

Figs. 5, 6 and 7 show the front, side and back views of one of these slabs. All the connections between the different instruments are made from the back by means of rectangular copper bars, so that the board presents a very simple appearance, and the manipulations are very easy.

The double-pole switch is indispensable for compound machines working in parallel. In fact, as Gramme remarked some time since, if two machines in series are to be made to work in parallel, it is necessary to add an equalising wire between the two machines. As this remark applies to compound machines, it is necessary, when a second machine is put on, to close at the same time the circuit of the equalising wire which ends at the plate in the middle of the commutator. The switch is thus formed of three plates, insulated from one another, but manipulated by the same handle. These plates catch between jaws connected with the terminals at which the wires end; by lowering the handle the circuit is closed; by raising it it is cut off; springs enable the plates to be kept in an inclined position when the circuit is open.

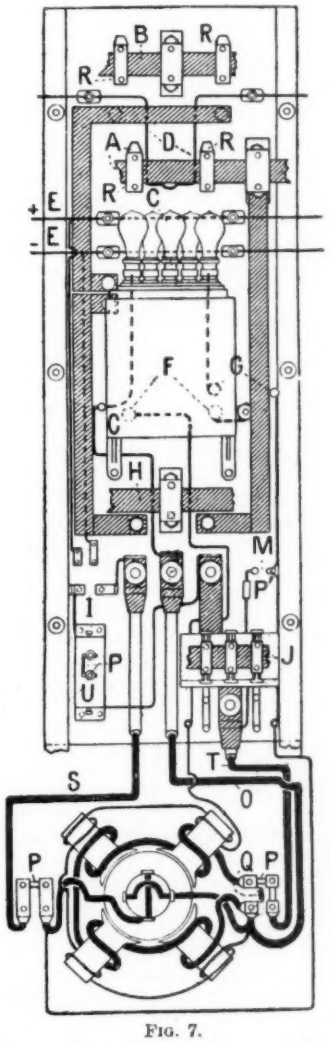


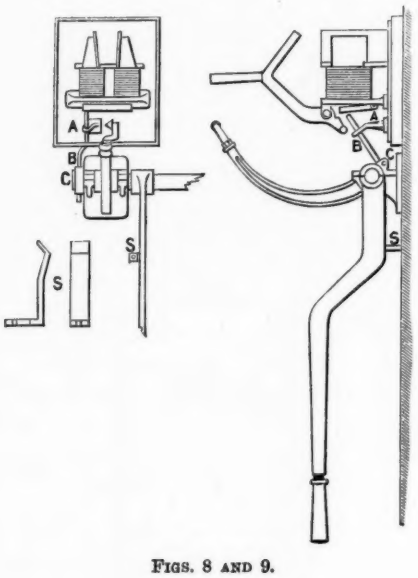
Fig. 7.

The exciting rheostat of these machines shows an interesting peculiarity. It consists of an additional resistance formed of lamps, the object of which is as follows:—If, for some reason or other, the exciting circuit of one of these machines of 500 volts had to be cut off, it might happen that in consequence of the self-induction that is produced in the field magnets, a short circuit might be formed in their winding. This accident is avoided by a very simple precaution: when the exciting circuit is cut off it is closed on a resistance formed of five lamps of 110 volts; the energy of the field is therefore expended in the lamps, which become very bright for a moment.

It may happen that a short circuit is produced along the line in consequence of the breaking of the trolley wire or the over-loading of a machine; it is then necessary to cut off the current in order to protect the machine; this is the object of the automatic cut-out which takes the place of the fusible leads, which are never very quickly affected by a sudden overload, and which, moreover, are not easily arranged for a tension of 500 volts. Figs. 8 and 9 give a front and side view of the automatic cut-out and of the making

* *L'Electricien.*

and breaking apparatus. It consists of an electro-magnet, the windings of which are placed in the circuit of the machine. If the current becomes too strong, the electro-magnet attracts an iron armature, thus giving free play to a spring which raises the plates of a commutator; the spark



Figs. 8 and 9.

is at this moment magnetically extinguished, for it is produced in the magnetic field formed by the pole pieces of the electro-magnet. The object of the breaking apparatus is to enable all the cut-outs placed on the same distribution board to cut off the current or re-establish it simultaneously. The making apparatus consists simply of a lever and a series of curved rods worked by this lever, enabling the current to be re-established simultaneously for all the machines when once the apparatus have worked.

The lightning guard is formed of rectangular discs insulated from one another, and does not present any novelty.

The voltmeter used is a Weston voltmeter placed horizontally on a stand; it is provided with two flexible wires connected with a handle terminated by conducting pins; by inserting these pins into holes made for the purpose, the voltmeter is put in circuit on one or the other machine.

From each dynamo there is a line for the lighting of the station.

The two slabs are placed side by side at a distance of one metre from the wall. Underneath is a base of polished slate very effective in appearance.

One pole of the dynamos is connected with the trolley wire and the other with the rails.

Rolling stock:—The rolling stock comprises 10 self-motive cars, which consist of three parts, the ironwork underneath with the axles, the framework of the car, the motors and controlling apparatus.

Ironwork and Woodwork.

The framework of the car is supported on the wheels by double springs. The ironwork consists of two U-shaped iron frames connected at their extremities by iron cross pieces of the same shape. Each frame comprises two pieces of iron in the form of a U, between which a first series of plate springs can act; these are fixed on the grease boxes, which in their turn move in the guiding plates. Between the two frames, and in the adjacent part of the axle of the framework, are placed two cross pieces of angle iron provided with bolts; on these cross pieces rest the electric motors with springs of India-rubber between; by this arrangement a considerable proportion of their weight is transmitted to the axles by the intervention of the plate springs; thus the violent shocks, which cause rapid wear and tear of the roads, are avoided. To strengthen the frames and render their connection with the guiding plates and the distance between the axles more invariable, iron tubes connect these different parts and convert the frames into armed beams, which, under an appearance of lightness, offer considerable resistance. At their two extremities, but underneath, the frames are connected by two U-shaped pieces of iron; on each of these are two springs connected at the top by another U-shaped piece of iron. The wooden support of the framework rests upon this last piece of iron. The tension of these two springs is regulated by a spiral spring placed below the frames.

The construction of the ironwork for electrical tramways is very much complicated by the necessity of placing the motors under the framework, of having wheels of rather large diameter, of having the floor of the car rather high, and, at the same time, having only one step for getting into the car. The difficulty is overcome by placing the platforms lower than the actual floor of the car. The distance of 2 metres between the axles is very little for a framework 8 metres in length, but no oscillation is to be feared, on account of the weight of the motors, and it enables the car to pass round curves of a very small radius. The weight of the ironwork, including the axles and the wheels, is 1,700 kg.

The brake used is a lever brake, which enables four iron skids fitted with wood to be applied simultaneously to the tyres of the wheels; springs release these skids from the wheels when the brake is not working. The manipulation of the brake is effected by means of a lever with a ratchet wheel and a chain. It is to be observed that the handle working the brake is of wood, in order to insulate this lever from the ironwork and the motors; this arrangement is not indispensable. The cars are supplied with brakes.

The platforms of the car are projecting, and to ensure their greater solidity they are supported by beams, which rest against the uprights of the car; these are really grooved, and the length of the groove is from the end of the upright to the point where the wood rests upon the framework.

The greatest fault to be found with these frames is the want of cross-supports; no part of them is in the form of a cross. This mode of construction is necessitated by the way in which the electric motors are placed.

(*To be continued.*)

REVIEWS.

A Treatise on the Measurement of Electrical Resistance. By W. A. Price, M.A. Oxford: The Clarendon Press.

The author of this work is well known as having had large practical experience in the construction of electrical measuring instruments, hence he is able to write on the subject of which the book treats with considerable authority. It may be questioned whether the somewhat severely classical style in which the opening part of the book is written is an advantage, it perhaps gives precision to the various statements, but a more colloquial language would be pleasanter reading for the practical electrician. This, however, is not a matter of great moment and is amply atoned for by the large amount of useful information which the work contains.

The author points out that he does not deal with the practical determination of the unit of resistance in absolute measure, as he has had no practical experience of the same. Some lucid description of this subject is badly wanted, but no one seems inclined to deal with it. Prof. Silvanus Thompson promised some years ago a "plain unvarnished tale" dealing with the matter, but we regret that he has not yet brought it to light.

In the second chapter the question of the materials for resistance coils is considered, and the author points out that if proper precautions are observed in manufacture, German silver seems mechanically trustworthy, no case of brittle or rotten wire being found in cases where the metal has been really well protected by varnish or a fair coat of paraffin wax. No opinion is expressed as to the value of platinoid. In regard to manganin, the alloy has been stated to be quite permanent in its properties, but we have heard that very unsatisfactory results have been obtained with it.

For standard coils which are not to be carried about it is recommended that they be kept immersed in Strange's A1 crystal oil.

It is suggested that ordinary standard resistances might be made with advantage by placing the coil in a thick copper case, with a mercury recess for inserting a thermometer, and dispensing with the water bath altogether.

Much useful information is given with reference to the construction and arrangement of bobbins for resistance coils, in many cases these are most awkwardly designed, so that the adjustment is difficult and their removal for repair anything but a simple matter. The winding of the coils also is by no means an easy task, and this is fully gone into. The curious circumstance is pointed out, that after winding German silver wires, soldering, &c., the resistance rises slightly and takes as long as three days to settle down to the permanent value; by keeping the coil at a high temperature for some hours after winding, the "settling down" period may be greatly shortened.

With reference to the form of the ebonite heads of plugs, Mr. Price says "the ebonite handle of a diamond form is a very bad one, it is inconvenient to handle, &c." He advocates the round headed and milled form as far preferable. To this we cannot agree; there are certainly inconveniences in the diamond form, but, as regards handling, a firmness of grip can be obtained which cannot be found in the rounded form, and this is distinctly favourable when much testing has to be done.

Some excellent descriptions are given of various forms of Wheatstone bridge, especially of the metre pattern.

The chapter on batteries and electrolytes does not possess any special features of novelty; the measurement of the resistance of electrolytes although it has been professed by many to have been accurately done, in our opinion possesses far more points of difficulty than is generally imagined, indeed, we are inclined to question the accuracy of many of the published results which have been accepted as being correct.

The mathematical theory of the Wheatstone bridge given in an appendix is rather better than usual, though it is not entirely as satisfactory or as clear as might be wished; the use of the differential calculus in the problems is not at all necessary, nor does it show, what we have over and over again pointed out, viz., that the conditions for an absolute maximum of sensitiveness may be very largely indeed departed from without practically diminishing this sensitiveness. The conditions laid down with reference to a maximum sensitiveness in Mance's method (dealt with in a special chapter), do not appear to us to be correct, though it is a little difficult to see where the discrepancy exists. It is a somewhat curious fact that in dealing with problems of this kind, scarcely two mathematicians arrive at the same conclusion as the results of their investigations.

Turning Lathes. Edited by J. Lukin, B.A. Fourth edition. Britannia Company, Colchester.

This new edition contains 68 pages of new matter relating chiefly to ornamental turning. There is also a useful chapter giving various receipts, which, unlike many of the kind, are really of value; instructions as to what *not* to do are given, as well as what to do. The Britannia Company are certainly doing a considerable benefit to others (as well as themselves) by issuing the book.

Chats on Invention. By John Martin. London: Offices of *Invention*, 54, Fleet Street.

This book, by the author of the "Presidential Address on The English Educational System," is a revival of a style of scientific book which was much in vogue half a century, and more, ago, and for which we have always felt the greatest admiration. The book is thoroughly well adapted for interesting and teaching the rising generation, and we cannot speak too highly of it. The letterpress consists of a dissertation by a Mr. M——, with his two sons and their two young friends. The evolution of an arm chair, from the tree trunk to the use of patent ball castors, commences the work, a discussion (with which the socialistic working man will, doubtless, entirely disagree) follows, which determines logically that the inventor does more for his fellow creatures than the mere labourer who executes the inventions. The ground gone over is very large, buffers, boot protectors, steel pens, the safety lamp, small pox! alpaca wool, the steam engine, amongst other things, being brought into the conversations. The importance of *noticing*, *thinking* and *trying* is well rammed home, and very properly so; the power of observation is too often left uncultivated and left to chance to develop; it the existence of such a faculty very seldom indeed seems to be realised.

In some points Mr. Martin is distinctly behind the times, for example, on page 116 the remark is made (after a description of a shockingly bad arrangement of a wind recorder)—"perhaps some day we may see such an automatic wind recording apparatus kept at our observatories"; it is strange that the writer should be unaware that there is hardly a public or private observatory where self-recording anemographs, both for direction and velocity, are not, and have not been for many years, in daily use. In spite of this and other defects, the book well deserves a very extensive sale.

Electrician-in-Charge. By Herbert Laws Webb. *Scribner's Magazine*, September, 1894. Sampson, Low, Marston, and Co.

A distinguished authority on literature and art has lately deplored the ultra-realism which stamps the character of modern fiction. He laments the truth and angularity of latter-day stories, and looks for the return of the good old honourable times of literary "lying" and romancing. This objection is certainly well-founded, but the fault seems to rest not so much upon the themes chosen as upon the author's treatment of them. There is plenty of proof that, in the hands of capable adapters, the most prosaic of subjects can be polished, and set and turned to account. Cable stories stand in no need of defence or apology, for there is a charm even to electricians themselves in the contemplation of the magic of submarine signalling, and familiarity with the art of cable laying will never dispel the feeling of mystery which raises this branch of commercial enterprise into the "rosy regions of romance." Cable stories have been made popular by the well-known and well-told tales of Mr. Archer P. Crouch; the present month finds another author in Mr. Herbert Laws Webb. Interest is supposed to centre around one "Harley Atwood," who has been left at a hut on the Pacific Coast during the laying of Peruvian cables. He deliberately sends a private message against standing orders, the upshot of which is the all but escape of a Spanish criminal. The truth leaks out, and Atwood is threatened with an inglorious exit from this world at the hands of Peruvian officials. At the perilous moment a British minister of state descends from the skies, and by magical strokes of diplomacy, a butterfly net, a coffee-pot, and the Union Jack, converts the cable hut into British territory. Atwood is saved, his secret is kept, the whole party retire to the Admiral's ship, and we know no more. There are a few points in the story, which, to an outsider, read a little strangely; for instance, we are told that "the company's rules expressly prohibited the transmission of messages," the idea evidently is that the cable is not yet handed over to the company from the engineers, otherwise the company would appear to have idiosyncrasies. Don Miguel Borrillas's Spanish is either phonetic, American, or corrupt, and hence he uses the ejaculation, "*Boino*," instead of the customary "*Bueno*." The nearest approximation to *boino*, given by our dictionary is a fishing-net; maybe some subtle reference to the butterfly-net, or to the capacity of spy, which was fulfilled by the shadow of Don M. Borrillas.

NEW PATENTS—1894.

17,167. "Improvements in pendants or suspenders for gas, oil, or other lamps." G. F. Sanders. Dated September 10th.

17,178. "An improved combined grain cleaner and magnetic separator." J. P. West. Dated September 10th.

17,180. "Improvements in electric arc lamps." R. H. Jahr. Dated September 10th.

17,219. "Improvements in or connected with feeding liquid fuel, such as petroleum and other oily and inflammable substances, to steam boiler or other furnaces, and burning same therein." R. Altschul. Dated September 10th.

17,233. "Improvements in oil or hydrocarbon engines." J. H. Knight. Dated September 11th.

17,235. "Improvements in electrical incandescent lamps." G. L. F. Philips. Dated September 11th.

17,278. "Improvements in mechanical telegraphs and working gear connected therewith." T. Tomlinson. Dated September 11th.

17,281. "An improved transmitter or transformer for electric currents." W. J. Still. Dated September 11th. (*Complete.*)

17,284. "Improvements relating to the transformation and distribution of electric currents." J. F. McElroy. Dated September 11th. (*Complete.*)

17,287. "Improvements in valves for compound direct-action engines." P. A. Newton. (Communicated by the Ingersoll-Sergeant Drill Company, United States.) Dated September 11th.

17,296. "Improvements in armatures for dynamo-electric machines." W. R. Lake. (Communicated by R. Eickemeyer, United States.) Dated September 11th. (*Complete.*)

17,297. "Improvements in armatures for dynamo-electric machines." W. R. Lake. (Communicated by R. Eickemeyer, United States.) Dated September 11th. (*Complete.*)

17,313. "Improvements in and relating to electric motors." J. S. Losch, J. H. Phillips, J. W. Moyer, and J. H. Williams. Dated September 11th. (*Complete.*)

17,335. "Improvements in the method of electrically governing the voltage of dynamos and speed of engines." J. Graham and H. Chapman. Dated September 12th.

17,353. "Improvements in charging primary batteries." S. Miller and C. J. Geist. Dated September 12th.

17,357. "Improvements in arc electric lamps." S. S. Allin and W. H. Wood. Dated September 12th.

17,365. "Improvements in clamps for raising and lowering electric or oil floor standards, also applicable for table lamps, music stands, and the like." R. W. Braham. Dated September 12th. (*Complete.*)

17,369. "An improvement in secondary voltaic batteries." L. Epstein. Dated September 12th.

17,378. "Improvements in direct-current transformers." A. B. Blackburn and T. L. Boyden. Dated September 12th.

17,379. "A safety device for electrical elevators or cranes." B. Willcox. (Communicated by the Eisenwerk vormals Nagel and Kaemp Actien Gesellschaft, Germany.) Dated September 12th.

17,445. "An improved electro-magnetic friction clutch." W. C. Bersey. Dated September 13th.

17,447. "Improvements in electrically propelled vehicles." W. C. Bersey. Dated September 13th.

17,458. "A self starter for gas or oil engines." J. A. Ewins. Dated September 14th.

17,498. "Improvements in or relating to electric alarm clocks." E. Benest. Dated September 14th.

17,502. "An improved electric time-signalling system and apparatus." P. R. J. Willis. (Communicated by W. A. Purcell, United States.) Dated September 14th.

17,510. "Improvements in or relating to electro-depositing apparatus." H. le R. Bridgman. Dated September 14th.

17,525. "Improvements in laying electric conductors and in forming branch connections therefrom." J. A. Jeckell. Dated September 14th.

17,526. "A heater for utilising the waste or excess heat from apparatus for heating by means of gas or oil." L. E. Jacquin. Dated September 14th. [Date applied for under Patents, &c., Act, 1883, Section 103, February 16th, 1894, being date of application in France.]

17,529. "Improvements in telephone receivers, transmitters, and silent closets." F. H. W. Higgins. Dated September 14th.

17,542. "Improvements in the construction of the lead lining or casing of cells or boxes of electric storage batteries." J. E. Liardet. Dated September 14th.

17,566. "Improvements in electrodes chiefly designed for use in electric accumulators and other electric apparatus." W. Schafer and A. Heinemann. Dated September 15th.

17,572. "Improvements in electrical switches." H. G. Keeble. Dated September 15th.

17,588. "Improvements in cables or conductors for electrolytic and other purposes." J. Leith. Dated September 15th.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1893.

13,111. "An improved traverse motion, applicable to the commutator and armature of dynamos and electric motors." J. Pease. Dated July 5th. There is a metal or wooden frame wherein revolves a worm wheel that is driven from the dynamo shaft, or by any available power. This worm-wheel is geared into a suitable wheel with a crank, to which is attached a connecting rod with an oblong hole or slot in which the crank works. The connecting rod is then secured to the shaft of the dynamo or electric motor, and can be arranged to cause the armature and commutator to traverse any required distance backward and forward as the shaft revolves. 1 claim.

14,003. "Improvements in or connected with electric circuit-closing devices for lamps arranged in series circuits." A. A. Goldston. Dated July 19th. Comprises a new combination of parts and apparatus of improved construction providing greater efficiency and certainty of action and general durability. 13 claims.

14,481. "Improvements in ammeters and voltmeters." E. F. Moy. Dated July 27th. Has for its object to construct such instruments in a manner allowing of comparatively rough handling without liability to get out of order, while they are sensitive and reliable in action. 5 claims.

14,562. "Improvements in alternate current dynamos and synchronising motors." H. W. Ravenshaw and L. B. Atkinson. Dated July 28th. The armature core may consist of an iron cylinder having a thick flange at each end projecting outwards, one or both of these flanges being built up of laminated iron plates arranged in a plane at right angles to the axis of the core. In the channel between the flanges is wound a magnetising coil so that the two flanges are of opposite polarity. On the periphery of the laminated flange or flanges are fixed a number of flat armature coils of insulated wire or tape with their magnetic axes in a radial direction, the other flange being left bare. The revolving part consists of a shaft supported in suitable bearings. The shaft carries a wheel or wheels from the face of which a number of iron or steel arms project, forming magnetic poles, called polar arms, in such a way that the magnetic circuit is completed in a number of places between them and the peripheries of the two flanges. The width of each polar arm is rather less than the total width of each armature coil, the number of coils being a multiple of the number of poles. 4 claims.

14,969. "Improvements relating to two-pole dynamos, motors, and the like." F. M. Newton and T. Hawkins. Dated August 4th. The inventors arrange one or both of the field magnets in such manner as to be capable of being slidden to and fro upon the bed-plate. This is effected by means of a suitable screw or screws, adapted to operate the magnet or magnets, which are mounted in a slide way as and when required, said screw or screws being themselves actuated by a ratchet wheel and lever or otherwise. 5 claims.

14,997. "Improvements in electric contacts for telegraphic vibrators." E. Edwards. (A communication from Paul la Cour, Denmark.) Dated August 4th. Claims:—1. A suspended pendulum-like body, serving as a moving contact, which, when touching a vibrator remains at rest when the vibrator is not working, but is driven off when the latter works and is held back by a catch in such a position that a fresh electrical circuit is completed, by which an alarm or warning is given until the pendulum is released from the catch, substantially as described and illustrated. 2. The application of the devices claimed in Claim 1, to several stations provided with different vibrators having different rates of vibration, so that the station or stations the vibrator of which is influenced by a corresponding intermittent electrical current, is warned, through an alarm bell or device, by the making or breaking of a current, until the pendulum-like body is allowed to return to its normal position, all substantially as described.

15,073. "Improvements in electric arc lamps." H. H. Cooper and The Electrical Installation Company, Ltd. Dated August 5th. Consists essentially in a pneumatic feed regulator in the form of a bell chamber sealed by immersion in glycerine or other liquid in combination with an air valve controlling the admission or escape of air to or from the chamber, as the case may be, and actuated by the core of a solenoid in a shunt to, or in series with, the arc. 3 claims.

15,074. "An improved electric coupling." H. H. Cooper and The Electrical Installation Company, Ltd. Dated August 5th. According to this invention the female part of the coupling consists of two split tubular contact sockets in axial alignment with each other and enclosed within a tubular inner casing, or between walls, of insulating material. 2 claims.

15,355. "An improved electric battery." H. S. Pyne and R. Thompson. Dated August 12th. Claims:—1. The use in combination with a battery of a vessel or vessels for storing the liquid agent or agents used in such battery in the manner and for the purpose substantially as described. 2. The method substantially as described of raising or lowering the level of the liquid agent or agents in the cells of a battery by raising or lowering the level of the liquid agent or agents respectively in the storing or receiving vessels. 3. The method substantially as described of transferring the liquid agent used in any vessel of a cell from such cell to any similar cell, or as the case may be to the proper receiving and storing vessel for each liquid agent and *vice versâ*.

16,025. "Automatic coupling for electro-motors." Siemens Bros. and Co., Ltd. (Communicated from abroad by Messrs. Siemens and Halske, of Berlin.) Dated August 24th. Claim:—In an electro-motor, arranging the armature and its shaft in such manner that they are free to be shifted longitudinally by the action of a spring or weight when no current is passing through the motor windings, whereby the one part of a clutch on the armature shaft is drawn out of engagement with the other part of the clutch on the shaft to be driven, while when the motor is put in circuit, the attraction exercised by the field magnets causes the armature and its shaft to be drawn back into their working position with the clutch engaged, substantially as described.

16,197. "Improvements in electric traction apparatus." P. Schoop. Dated August 28th. Relates to an arrangement of an accumulator battery in combination with apparatus applicable to any of the known systems of electric traction, in such a manner as to economise power and provide for emergencies. 4 claims.

17,445. "Improvements in insulators for pipe conduits for electric mains." W. H. Scott. Dated September 16th. The inventor makes the insulators of glass or hard vitrified stoneware, or other suitable material, and shapes them so that they catch in the pipes in two or more places. 1 claim.